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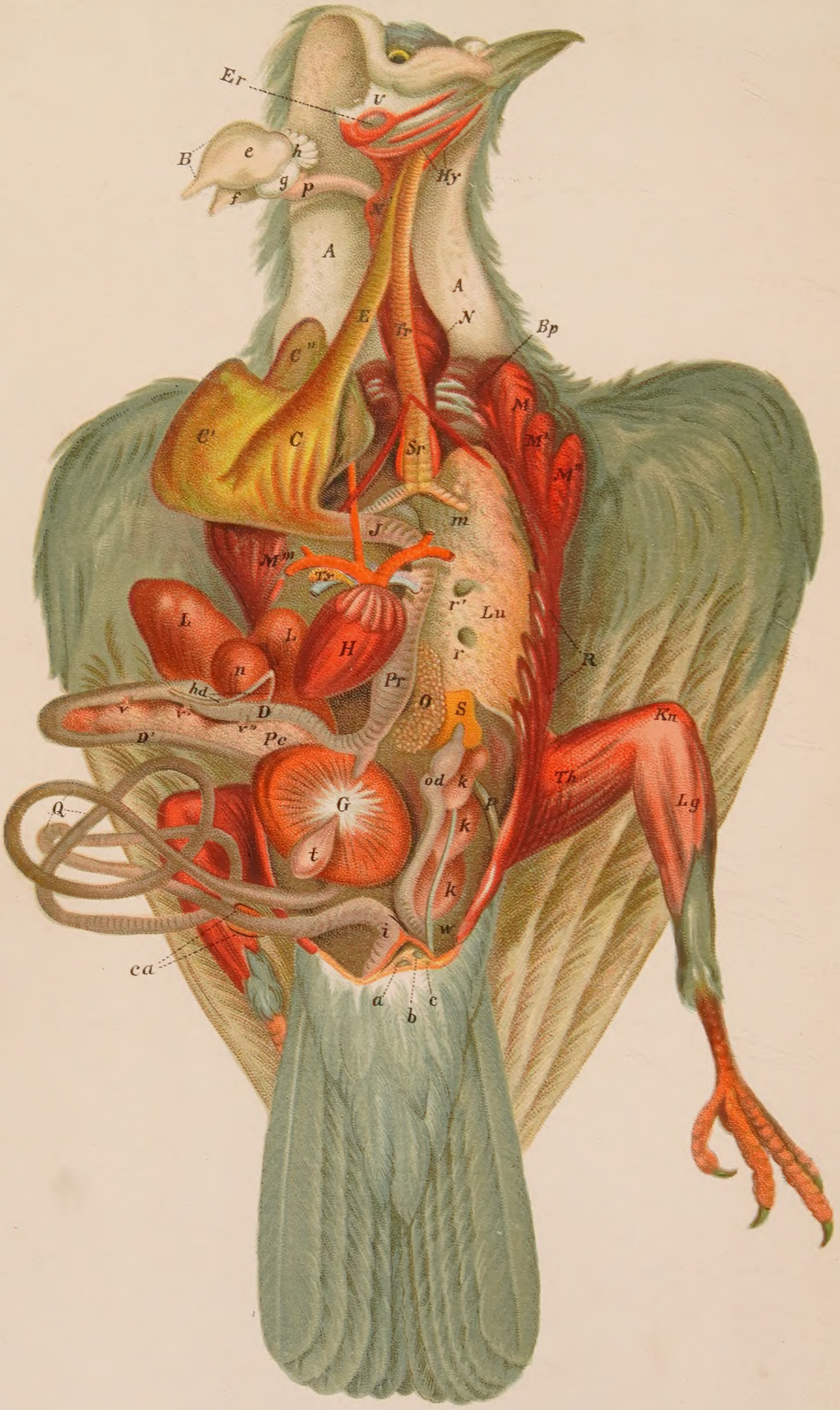

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ANATOMY OF PIGEON.

Coue's Key N.A Birds.

KEY

TO

NORTH AMERICAN BIRDS.

CONTAINING A CONCISE ACCOUNT OF EVERY SPECIES OF LIVING AND FOSSIL BIRD AT PRESENT KNOWN FROM THE CONTINENT NORTH OF THE MEXICAN AND UNITED STATES BOUNDARY, INCLUSIVE OF GREENLAND AND LOWER CALIFORNIA,

WITH WHICH ARE INCORPORATED

GENERAL ORNITHOLOGY:

AN OUTLINE OF THE STRUCTURE AND CLASSIFICATION OF BIRDS;

AND

FIELD ORNITHOLOGY,

A MANUAL OF COLLECTING, PREPARING, AND PRESERVING BIRDS.

The Fourth Edition,

EXHIBITING THE NEW NOMENCLATURE OF THE AMERICAN ORNITHOLOGISTS' UNION, AND INCLUDING DESCRIPTIONS OF ADDITIONAL SPECIES, ETC.

BY ELLIOTT COUES, A.M., M.D., PH.D.,

Late Captain and Assistant Surgeon U. S. Army; and Secretary U. S. Geological Survey; Vice-President of the American Ornithologists' Union, and Chairman of the Committee on the Classification and Nomenclature of North American Birds; Foreign Member of the British Ornithologists' Union; Corresponding Member of the Zoölogical Society of London; Member of the National Academy of Sciences, of the Faculty of the National Medical College, of the Philosophical and Biological Societies of Washington, of the General Council of the Theosophical Society of India, etc.

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To

SPENCER FULLERTON BAIRD,

NESTOR OF AMERICAN ORNITHOLOGISTS,

This Work,

BEARING TO OTHERS THE TORCH RECEIVED FROM HIM IN EARLIER DAYS,

Is Dedicated.

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PREFACE TO THE FOURTH EDITION.

IN presenting a new edition of the KEY to those who are interested in North American Birds, the publishers desire the author to add a word by way of preface. But little need be said of a book which speaks for itself in passing through several editions to supply that demand for a standard textbook of ornithology which this work has itself done much to create, by stimulating and satisfying an interest in one of the most delightful departments of Natural History.

The part which the KEY has taken in the evolution of the subject since 1872 is sketched in the "Historical Preface" (pp. xxvi–xxx), first introduced in the Second Edition, 1884. Since the founding of the American Ornithologists' Union in 1883 the impetus then given to the study of birds has resulted in a momentum directly proportionate to the number of workers in this field and to the length of time these have been engaged. I could wish the fruits of such unparalleled activity were all sound and ripe, but they are not; growth has been forced to some extent in rival hot-houses, and the familiar parable of wheat and tares finds a fresh illustration. Too quick transition from an old to a new order of things in the technicalities of our subject has brought disorder, as usual. Till the pace slackens somewhat, so that we can see where we stand, I do not think it would be wise to recast the KEY.

Therefore, the only change in the present edition is the addition of a Second Appendix, beginning page 897.

E. C.

PREFACE TO THE THIRD EDITION.

THE second edition of the "Key," which appeared in May, 1884, has already been out of print for more than a year. Though aware of the continued demand for a standard work of reference, the author has been unable to meet it more promptly, having meanwhile accepted some other literary engagements which proved imperative in their demand upon his capacity for work. Slight as the requisite revision of this book has proven to be, it did not seem expedient to go to press again without recognizing the steps American Ornithology has taken during the past three years, though these may be called many rather than great ones. There is so little to change in the substance of the book that it has been thought decidedly best to reprint from the same plates, and put what new matter has come to hand in the form of an Appendix. However much there is that might have advantageously gone into the second edition, but did not, the author is satisfied with nearly everything that did go in, and quite ready to submit it all to the still further test of time. The transition from what some of his friends have called the "Couesian Period" may mean a change in form rather than in fact.

The naming of our birds, as an art distinguished from the science of knowing them, has lately been pitched in a key so high that the familiar notes of the former "Key" might jangle out of tune, or be lost entirely, were the attempt made to reset them just now. During the confusion unavoidably incident to such sweeping changes in nomenclature as we have recently made, it will be a decided benefit to the student, the sportsman, and the amateur, if not also to every working ornithologist, to be provided with a convenient means of comparing the older with the newer style of nomenclature we have adopted, until each one shall have grown accustomed to the change of spectacles. This accommodation is afforded by the present edition, which leaves the names and their num-

bers untouched in the body of the text, and then adjusts them to the new angle of vision in the Appendix, in parallel columns. Thus the new "Key" turns either way; or, to vary the metaphor, the renovated structure stands Janus-faced, looking both ways at once — backward upon its old self, of which it has no cause to be ashamed; forward upon another self, of which it has much reason to be proud.

The train of incidents which resulted in what may be called a nomenclatural explosion was fired at the founding of the American Ornithologists' Union at New York, in September, 1883. As one of three persons who brought that happy episode upon an unsuspecting bird-world, which nevertheless greeted their stroke with acclamation, the author must plead a modesty act in bar of trial of his pen on that particular count. But as the honor was his of presiding over the first Congress of the Union, whilst the ideas of its founders were shaped into a permanent and world-wide organization, so also it fell to his lot to appoint several committees for the despatch of business the Union at once took in hand; and of one of these he has to speak here.

This particular wheel within other wheels turned upon a resolution of the Union "that the Chairman appoint a committee of five, including himself, to whom shall be referred the question of a revision of the Classification and Nomenclature of the Birds of North America." Having accepted the situation, the author held with his esteemed colleagues many sessions of the Committee in Washington and New York, and in April, 1885, offered to the Union the result of much joint labor. The report of the Committee being accepted, it was ordered to be printed, and it appeared in 1886 in an octavo volume of 400 pages, entitled "The Code of Nomenclature and Check-list of North American Birds, adopted by the American Ornithologists' Union," etc.

The objects which we kept steadily in view were: first, to establish certain sound principles or canons of nomenclature applicable to zoölogy at large as well as to ornithology; and, secondly, to apply these rules consistently and effectually to the naming of North American birds. Others must be left to judge how well or ill these purposes may have been accomplished, but the simple fact is that no sooner had the book appeared than it became the standard and indeed the only recognized Nomenclator in American Ornithology. That which the Committee had stamped with the seal of the Union became the current coin of the realm, other than which our venerable fowl, The Auk, should know none.

In estimating the probable consequences for the long run, it is necessary to discriminate between any given ornithological fact and the handle we may agree to give that fact. The former is a natural fixity, the latter is a movable furniture; the former is subject to no authority we can set up, the latter is wholly arbitrary, determinable at our pleasure. Uniformity of nomenclature is so obvious and decided a practical convenience that even at the risk of seeming to laud work in which he had a hand, the author cannot too strongly urge compliance with the Union's code, and adherence to the set of names the Union has adopted. These may not be the best possible, but they are the best we have.

The author's insistence upon this point does not of course extend to any case where an error of ornithological fact may appear. That is an entirely different matter. Reserving to himself, as he certainly does, the right of individual judgment in every question of ornithological science, he is the last to persuade others to refrain from equal freedom of expert opinion. "So many men, so many minds," even when the number is only five; no individual opinion is necessarily reflected upon any point in the Code and Check-list; it is the collective voice of a majority of the Committee that is heard in every instance. The occasion for individual dissent on the part of any member of that body, as of any other writer upon the subject, arises when in his private capacity as an author he has, as it were, to pass upon and approve or disapprove any results of the labors of others. The Appendix to the present edition of the "Key" unavoidably brings up such an occasion. Yet that he may not even seem to reflect upon any of his co-workers, his criticism express or implied has been sedulously reduced to its lowest terms. It consists chiefly in declining to admit to the "Key" some forms that the Committee have deemed worthy of recognition by name. Indeed he has preferred to err, if at all, on the other side, desiring to give the user of this book the later results of the whole Committee.

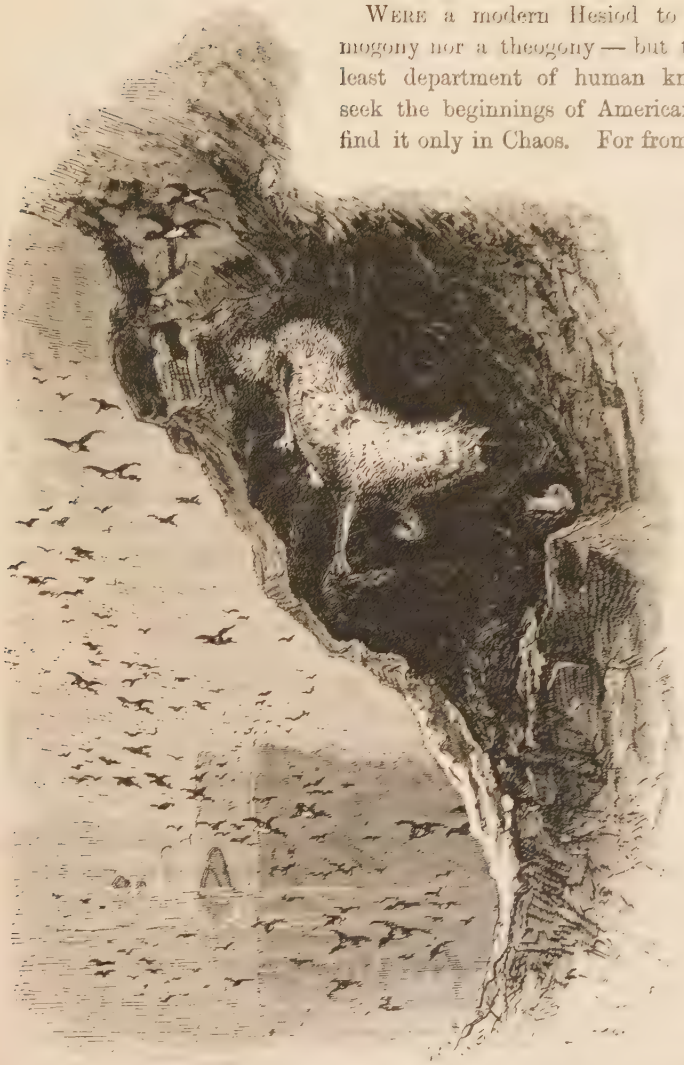
Nevertheless he must here record an earnest protest, futile though it may be, against the fatal facility with which the system of trinomials lends itself to sad consequences in the hands of immature or inexperienced specialists. No allusion is here intended to anything that has been done, but he must reiterate what was said before (Key, p. xxvii) respecting what may be done hereafter if more judicious conservatism than we have enjoyed of late be not brought to bear down hard upon trifling incompetents. The "trinomial tool" is too sharp to be made a toy; and even if we do not cut our own fingers with it, we are likely to cut the throat of the whole system of naming we have reared with such

care. Better throw the instrument away than use it to slice species so thin that it takes a microscope to perceive them. It may be assumed, as a safe rule of procedure, that it is useless to divide and subdivide beyond the fair average ability of ornithologists to recognize and verify the result. Named varieties of birds that require to be "compared with the types" by holding them up slantwise in a good strong light, — just as the ladies match crewels in the milliner's shop, — such often exist in the cabinets or in the books of their describers, but seldom in the woods and fields.

E. C.

Smithsonian Institution,
Washington, D.C., *April, 1887*.

HISTORICAL PREFACE.



WERE a modern Hesiod to essay — neither a cosmogony nor a theogony — but the genesis of even the least department of human knowledge, — were he to seek the beginnings of American Ornithology, he would find it only in Chaos. For from this sprang all things, great and small alike, to pass through Night and Nemesis to the light of days which first see orderly progress in the course of natural evolution, when is first established some sequence of events we recognize as causes and effects. Then there is system, and formal law; there science becomes possible; there its possible history begins.

Long was the time during which the birds of our country were known to its inhabitants, after the fashion of the people of those days, — known as things of which use could be made, and studied, too, that use might be made of them. But this period is prehistoric; no evidence remains, save in some quaint pictograph or rudely graven image. There followed a period — shorter by far than the former one, though it endures to-day — when the same

birds awakened in other men an interest they could not excite in a savage breast, and the sense of beauty was felt. Use and Beauty! What may not spring from such divinely mated pair, when once they brood upon the human mind, like halcyons stilling troubled waters, sinking the instincts of the animal in the restful, satisfying reflections of the man?

The history of American Ornithology begins at the time when men first wrote upon American birds; for men write nothing without some reason, and to reason at all is the beginning of science, even as to reason aright is its end. The date no one can assign, unless it be arbitrarily; it was during the latter part of the sixteenth century, which, with the whole of the seventeenth, represents the formative or embryonic period during which were gathering about the germ the crude materials out of which an ornithology of North America was to be fashioned. As these accumulated and were assimilated, — as the writings multiplied and books bred books, "each after its kind," this special department of knowledge grew up, and its form changed with each new impress made upon its plastic organization.

Viewing in proper perspective these three centuries and more which our subject has seen — passing in retrospect the steps of its development — we find that it offers several phases, representing as many "epochs" or major divisions, of very unequal duration, and of scientific significance inversely proportionate to their respective lengths. All that went before 1700 constitutes the first of these, which may be termed the *Archaic* epoch. The eighteenth century witnessed an extraordinary event, the consequence of which to systematic zoölogy cannot be over-estimated; it occurred almost exactly in the middle of the century, which is thus sharply divided into a *Pre-Linnæan* epoch, before the institution of the binomial nomenclature, and a *Post-Linnæan* epoch, during which this technic of modern zoölogy was established, — each approximately of half a century's duration. In respect of our particular theme, the first quarter of the nineteenth century saw the "father of American ornithology," whose spirit pointed the crescent in the sky of the *Wilsonian* epoch. During the second quarter, these horns were filled with the genius of the *Audubonian* epoch. In the third, the plenteousness of a master mind has marked the *Bairdian* epoch.

Clearly as these six epochs may be recognized, there is of course no break between them; they not only meet, but merge in one another. The sharpest line is that which runs across Linnæus at 1758; but even that is only visible in historical perspective, while the assignation of the dates 1700 and 1800 is rather a chronological convenience than otherwise. Nothing absolutely marks the former; and Wilson was unseen till 1808.

The Archaic epoch stretches into the dim past with unshifting scene, even at the turning-point of the two centuries in which it lies. It is otherwise with the rest; their shapes have incessantly changed; and several have been the periods in each of them during which their course of development has been accelerated or retarded, or modified in some special feature. These changes have invariably coincided with — have in fact been induced by — the appearance of some great work; great, not necessarily in itself, but in its relation to the times, and thus in the consequences of the interaction between the times and the author who left the science other than he found it. The edifice as it stands to-day is the work of all, even of the humblest, builders; but its plan is that of the architects who have modelled its main features, and the changes they have success-

ively wrought are the marks of progress. It is consequently possible, and it will be found convenient, to subdivide the epochs named (excepting the first) into lesser natural intervals of time, which may be called "periods," to each of which may attach the name of the architect whose design is expressed most clearly. I recognize fifteen such periods, of very unequal duration, to which specific dates may attach. Seven of these fall in the last century; eight in the three-quarters of the present century. We may pass them in brief review.

The Archaic Epoch: to 1700.

Mere mention or fragmentary notice of North American birds may be traced back to the middle of the sixteenth century; but, up to the eighteenth, no book entirely and exclusively devoted to the subject had appeared. The Turkey and the Humming-bird were among the earliest to appear in print; the latter forms the subject of the earliest paper I have found, exclusively and formally treating of any North American bird as such, and this was not until 1693, when Hamersly described the "American Tomineius," as it was called. One of the largest, as well as the smallest of our birds, — the turkey, early came in for a share of attention. The germs of the modern "faunal list," — that is to say, notes upon the birds of some particular region or locality, — appeared early in the seventeenth century, and continued throughout; but only as incidental and very slight features of books published by colonists, adventurers, and missionaries, in their several interests, — unless Hernandez's famous "Thesaurus" be brought into the present connection. Among such books containing bird-matter may be noted Smith's "Virginia," 1612; Hamor's "Virginia," 1615; Whitbourne's "Newfoundland," 1620; Higginson's "New England," 1630; Morton's "New English Canaan," 1632; Wood's "New England's Prospect," 1634; Sagard Theodat's "Voyage," 1632; Josselyn's "New England's Rarities," 1672; — and so on, with a few more, — sometimes mere paragraphs, sometimes a page or a formal chapter, — but scarcely anything to be now considered except in a spirit of curiosity.

The Pre-Linnæan Epoch: 1700–1758.

(1700–1730.)

The Lawsonian Period. — It may be a *lucus a non* to call this the "Lawsonian" period; but a name is needed for the portion of this epoch prior to Catesby, during which no other name is so prominent as that of John Lawson, Gentleman, Surveyor-General of North Carolina, whose "Description and Natural History" of that country contains one of the most considerable faunal lists of our birds which appeared before 1730, and went through many editions, — the last of these being published at Raleigh, in 1860. The several early editions devote some fifteen or twenty pages to birds, — an amount augmented considerably when Brickell appropriated the work in 1737. The Baron de la Hontan did similar service to Canadian birds in his "Voyages," 1793; but, on the whole, this period is scarcely more than archaic.

(1730–1748.)

The Catesbian Period. — This comprises the time when Mark Catesby's great work was appearing by instalments. "The Natural History of Carolina, Florida," etc., is the

first really great work to come under our notice; its influence was immediate, and is even now felt. It is the "Audubon" of that time; a folio in two volumes, dating respectively 1731 and 1743, with an appendix, 1748; passing to a second edition in 1754, to a third in 1771, under the supervision of Edwards; reproduced in Germany, in "Seligmann's Sammlung," 1749–76. It was published in parts, the date of the first of which I believe to have been 1730, though it may have been a little earlier. Volume I, containing the birds, appears to have been issued in five parts, and was made up in 1731; it consists of a hundred colored plates of birds, with as many leaves of text; a few more birds are given in the appendix, raising the number to 113. These illustrations are recognizable almost without exception; most of the species are for the first time described and figured; they furnish the basis of many subsequently named in the Linnæan system; the work was eventually provided by Edwards with a Linnæan concordance or index; and altogether it is not easy to overestimate the significance of the Catesbian period, due to this one work; for no other book requires or indeed deserves to be mentioned in the same connection, though a few contributions, of somewhat "archaic" character, were made by various writers.

(1748–1758.)

The Edwardsian Period. — This bridges the interval between Catesby and the establishment of the binomial nomenclature, and finishes the Pre-Linnæan epoch. No great name of exclusive pertinence to North American ornithology appears in this decade. But the great naturalist whose name is inseparably associated with that of Catesby had begun in 1741 the "Natural History of Uncommon Birds," which he completed in four parts or volumes, in 1751, and in which the North American element is conspicuous. This work contains two hundred and ten colored plates, with accompanying text, forming a treatise which easily ranks among the half-dozen greatest works of the kind of the Pre-Linnæan epoch, and passed through several editions in different languages. Its impress upon American ornithology of the time is second only to that made by Catesby's, of which it was the natural sequence, if not consequence It bore similarly upon birds soon to be described in binomial terms, and was shortly followed by the not less famous "Gleanings of Natural History," 1758–64, a work of precisely the same character, and in fact a continuation of the former. Edwards also made some of our birds the subject of special papers before the Philosophical Society, as those of 1755 and 1758 upon the Ruffed Grouse and the Phalarope. It may be noted here that one of the few special papers upon any American bird which Linnæus published appeared in this period, he having in 1750 first described the Louisiana Nonpareil (*Passerina ciris*). This period also saw the publication of part of the original Swedish edition of Peter Kalm's "Travels," 1753–61, which went through numerous editions in different languages. Kalm was a correspondent of Linnæus; the genus of plants, *Kalmia*, commemorates his name; his work contains accounts of many of our birds, some of them the bases of Linnæan species; and he also published, in 1759, a special paper upon the Wild Pigeon. As in the Catesbian period, various lesser contributions were made, but none requiring comment. Thus Lawson, as representing the continuation of a preceding epoch, and the associated names of Catesby and Edwards in the present one, have carried us past the middle of the last century.

The Post-Linnæan Epoch: 1758–1800.

(1758–1766.)

The Linnæan Period. — An interregnum here, during which not a notable work or worker appears in North American ornithology itself. But events elsewhere occurred, the reflex action of which upon our theme is simply incalculable, fully requiring the recognition of this period. The dates, 1758–1766, are respectively those of the appearance of the tenth and of the twelfth edition of the "Systema Naturæ" of Linnæus. In the former the illustrious Swede first formally and consistently applied his system of nomenclature to all birds known to him; the latter is his completed system, as it finally left his hands; and from then to now, zoölogists and especially ornithologists have disputed whether 1758 or 1766 should be taken as the starting-point of zoölogical nomenclature. In ornithology, the matter is still at issue between the American and the British schools. However this may result, the fact remains that during this "Linnæan period," 1758 to 1766, we have the origin of all the tenable specific names of those of our birds which were known to Linnæus; the gathering up and methodical digestion and systematic arrangement of all that had gone before. Let this scant decade stand, — mute in America, but eloquent in Sweden, and since applauded to the echo of the world.

Nor is this all. The year 1760 saw the famous "Ornithologia" of Mathurin Jacques Brisson (born April 20, 1725 — died June 23, 1806), in six portly quartos with 261 folded plates, and elaborate descriptions in Latin and French of hundreds of birds, a fair proportion of which are North American. Many are described for the first time, though unfortunately not in the binomial nomenclature. The work holds permanent place; and most of the original descriptions of Brisson's are among the surest bases of Linnæan species.

(1766–1785.)

The Forsterian Period. — Nearly twenty years have now elapsed with so little incident that two brochures determine the complexion of this period. John Reinhold Forster was a learned and able man, whose connection with North American ornithology is interesting. In 1771 he published a tract, now very scarce and of no consequence whatever, entitled "A Catalogue of the Animals of North America." But it was the first attempt to do anything of the sort, — in short, the first thing of its kind. It gives 302 birds, neither described nor even named scientifically. But that was a large number of North American birds to even mention in those days, — more than Wilson gave in 1814. Forster followed up this exploit in 1772 with an interesting and valuable account of 58 birds from Hudson's Bay, occupying some fifty pages of the "Philosophical Transactions." Several of these birds were new to science, and were formally named, — such as our White-throated Sparrow, Black-poll Warbler, Hudsonian Titmouse, and Eskimo Curlew. Aside from its intrinsic merit, this paper is notable as the first formal treatise exclusively devoted to a collection of North American birds sent abroad. The period is otherwise marked by the publication in 1780 of Fabricius' "Fauna Grœnlandica," in which some 50 birds of Greenland receive attention; and especially by the appearance of a great statesman and one of the Presidents of the United States in the rôle of ornithologist, Thomas Jefferson's "Notes on the State of Virginia" having been first pri-

vately printed in Paris in 1782, though the authorized publication was not till 1787. It contains a list of 77 birds of Virginia, fortified with references to Catesby, Linnæus, and Brisson, as the author's authorities. There were many editions, one dating 1853.

The long publication in France of one of the monumental works on general ornithology coincides very nearly with this period. I refer of course to Buffon and his collaborators. The "Histoire Naturelle des Oiseaux," by Buffon and Montbeillard, dates in its original edition 1770–1783, being in nine quarto volumes with 264 plain plates. It forms a part of the grand set of volumes dating 1749–1804 in their original editions. With the nine bird-volumes are associated the magnificent series of colored plates known as the "Planches Enluminées," published in 42 fascicles from 1765 to 1781. The plates are 1008 in number, of which 973 represent birds.

(1785–1791.)

The Pennantian Period. — A great landmark — one of the most conspicuous of the last century — was set up with the appearance in 1785 of the second volume of Thomas Pennant's "Arctic Zoology." The whole work, in three quarto volumes with many plates, 1784–1787, was "designed as a sketch of the Zoölogy of North America." In this year, also, John Latham completed the third volume (or sixth part) of his "General Synopsis of Birds." These two great works have much in common, in so far as a more restricted treatise can be compared with a more comprehensive one; and in the history of our subject the names of Latham and Pennant are linked as closely as those of Catesby and Edwards. The parallel may be drawn still further; for neither Pennant nor Latham (up to the date in mention) used binomial names; their species had consequently no standing; but they furnished to Gmelin in 1788 the same bases of formally-named species of the thirteenth edition of the "Systema Naturæ," that Catesby and Edwards had afforded Linnæus in 1758 and 1766. Pennant treated upwards of 500 nominal species of North American Birds. The events at large of this brief but important period were the progress of Latham's Supplement to his Synopsis, the first volume of which appeared in 1787, though the second was not completed till 1801; the appearance in 1790 of Latham's "Index Ornithologicus," in which his birds receive Latin names in due form; and the publication in 1788 of the thirteenth edition of the "Systema Naturæ," as just said.

We are so accustomed to see "Linn." and "Gm." after the names of our longest-known birds that we almost unconsciously acquire the notion that Linnæus and Gmelin were great discoverers or describers of birds in those days. But the men who made North American ornithology what it was during the last century were Catesby, Edwards, Forster, Pennant, Latham, and Bartram. For "the illustrious Swede" was in this case little more than a methodical cataloguer, or systematic indexer; while his editor, Gmelin, was merely an industrious, indiscriminate compiler and transcriber. Neither of these men *discovered* anything to speak of in this connection.

(1791–1800.)

The Bartramian Period. — William Bartram's figure in the events we are sketching is a notable one, — rather more on account of his bearing upon Wilson's subsequent career than of his own actual achievements. Wilson is often called the "father of Ameri-

can ornithology;" if this designation be apt, then Bartram may be styled its godfather. Few are fully aware how much Wilson owed to Bartram, his "guide, philosopher, and friend," who published in 1791 his "Travels through North and South Carolina," containing much ornithological matter that was novel and valuable, including a formal catalogue of the birds of the Eastern United States, in which many species are named as new. I have always contended that those of his names which are identifiable are available, though Bartram frequently lapsed from strict binomial propriety; and the question furnishes a bone of contention to this day. Many birds which Wilson first fully described and figured were really named by Bartram, and several of the latter's designations were simply adopted by Wilson, who, in relation to Bartram, is as the broader and clearer stream to its principal tributary affluent. The notable "Travels," freighted with its unpretending yet almost portentous bird-matter, went through several editions and at least two translations; and I consider it the starting-point of a distinctively American school of ornithology.

We have seen, in several earlier periods, that men's names appear in pairs, if not also as mates. Thus, Catesby and Edwards; Linnæus and Gmelin; Pennant and Latham; and, perhaps, Buffon and Brisson. The Bartramian *alter ego* is not Wilson, but Barton, whose "Fragments of the Natural History of Pennsylvania," 1799, closed the period which Bartram had opened, and with it the century also. Benjamin Smith Barton's tract, a folio now very scarce, is doubly a "fragment," being at once a work never finished, and very imperfect as far as it went; but it is one of the most notable special treatises of the last century, and I think the first book published in this country that is entirely devoted to ornithology. But its author's laurels must rest mainly upon this count, for its influence or impression upon the course of events is scarcely to be recognized, — is incomparably less than that made by Bartram's "Travels," and by his mentorship of Wilson.

By the side of Bartram and Barton stand several lesser figures in the picture of this period. Jeremy Belknap treated the birds of New Hampshire in his "History" of that state (1792). Samuel Williams did like service for those of Vermont in his "History" (1794). Samuel Hearne, a pioneer ornithologist in the northerly parts of America, foreshadowed, as it were, the much later "Fauna Boreali-Americana" in the narrative of his journey from Hudson's Bay to the Northern Ocean — a stout quarto published in 1795. Here a chapter of fifty pages is devoted to about as many species of birds; and Hearne's observations have a value which "time, the destroyer," has not yet wholly effaced.

The Wilsonian Epoch: 1800–1824.

(1800–1808.)

The Vieillotian Period. — As we round the turn of the century a great work occupies the opening years, before the appearance of Wilson, — a work by a foreigner, a Frenchman, almost unknown to or ignored by his contemporaries in America, although he was already the author of several illustrated works on ornithology when, in 1807, his "Histoire Naturelle des Oiseaux de l'Amérique Septentrionale" was completed in two large folio volumes, containing more than a hundred engravings, with text relating to several hundred species of birds of North America and the West Indies; many of them figured for

the first time, or entirely new to science. This work, bearing much the same relation to its times that Catesby's and Edwards' respectively did to theirs, is said to have been published in twenty-two parts of six plates each, probably during several years; but the date of its inception I have never been able to ascertain. However this may be, Vieillot alone and completely fills a period of eight years, during which no other notable or even mentionable treatise upon North American birds saw the light. Vieillot's case is an exceptional one. As the author of numerous splendidly illustrated works, all of which live; of a system of ornithology, most of the generic names contained in which are ingrained in the science; of very extensive encyclopædic work in which hundreds of species of birds receive new technical names: Vieillot has a fame which time rather brightens than obscures. Yet it is to be feared that the world was unkind during his lifetime. At Paris, he stood in the shadow of Cuvier's great name; Temminck assailed him from Holland; while, as to his work upon our birds, many years passed before it was appreciated or in any way adequately recognized. Thus, singularly, so great a work as the "Histoire Naturelle" — one absolutely characteristic of a period — had no appreciable effect upon the course of events till long after the times that saw its birth, when Cassin, Baird, and others brought Vieillot into proper perspective. There is so little trace of Vieillot during the Wilsonian and Audubonian epochs, that his "Birds of North America" may almost be said to have slept for half a century. But to-day, the solitary figure of the Vieillotian period stands out in bold relief.

(1808–1824.)

The Wilsonian Period. — The "Paisley weaver;" the "Scotch pedler;" the "melancholy poet-naturalist;" the "father of American ornithology," — strange indeed are the guises of genius, yet stranger its disguises in the epithets by which we attempt to label and pigeon-hole that thing which has no name but its own, no place but its own. Alexander Wilson had genius, and not much of anything else — very little learning, scarcely any money, not many friends, and a paltry share of "the world's regard" while he lived. But genius brings a message which men must hear, and never tire of hearing; it is the word that comes when the passion that conceives is wedded with the patience that achieves. Wilson was a poet by nature, a naturalist by force of circumstances, an American ornithologist by mere accident, — that is, if anything can be accidental in the life of a man of genius. As a poet, he missed greatness by those limitations of passion which seem so sad and so unaccountable; as the naturalist, he achieved it by the patience that knew no limitation till death interposed. As between the man and his works, the very touchstone of genius is there; for the man was greater than all his works are. Genius may do that which satisfies all men, but never that which satisfies itself; for its inspiration is infinite and divine, its accomplishment finite and human. Such is the penalty of its possession.

Wilson made, of course, the epoch in which his work appeared, and I cannot restrict the Wilsonian period otherwise than by giving to Vieillot his own. The period of Wilson's actual authorship was brief; it began in September, 1808, when the first volume of the "American Ornithology" appeared, and was cut short by death before the work was finished. Wilson, having been born July 6, 1766, and come to America in 1794, died August 23, 1813, when his seventh volume was finished; the eighth and ninth being

completed in 1814 by his friend and editor, George Ord. But from this time to 1824, when Bonaparte began to write, the reigning work was still Wilson's, nothing appearing during these years to alter the complexion of American ornithology appreciably. Wilson's name overshadows nearly the whole epoch, — not that others were not then great, but that he was so much greater. This author treated about 280 species, giving faithful descriptions of all, and colored illustrations of most of them. There are numerous editions of his work, of which the principal are Ord's, 1828–29, in three volumes; Jameson's, 1831, in four; Jardine's, 1832, in three; and Brewer's, 1840, in one; all of these, excepting of course the first one, containing Bonaparte's "American Ornithology" and other matter foreign to the original "Wilson." In 1814, just as "Wilson" was finished, appeared the history of the memorable expedition under Lewis and Clarke — an expedition which furnished some material to Wilson himself, as witness Lewis' Woodpecker, Clarke's Crow, and the "Louisiana" Tanager; and more to Ord, who contributed to the second edition of "Guthrie's Geography" an article upon ornithology. Ord's prominence in this science, however, rests mainly upon his connection with Wilson's work, as already noted. Near the close of the Wilsonian period, Thomas Say gave us important notices of Western birds, upon the basis of material acquired through Long's Expedition to the Rocky Mountains, the account of which appeared in 1823. In this work, Say described sundry species of birds new to science; but he was rather an entomologist than an ornithologist, and his imprint upon our subject is scarcely to be found outside the volume just named. A noted — some might say rather notorious — character appeared upon the scene during this period, in the person of C. S. Rafinesque, who seems to have been a genius, but one so awry that it is difficult to do aught else than misunderstand him, unless we confess that we scarcely understand him at all. In the elegant vernacular of the present day he would be called a crank; but I presume that term means that kind of genius which fails of interpretation; for an unsuccessful genius is a crank, and a successful crank is a genius. For the rest, the Wilsonian period was marked by great activity in Arctic exploration, in connection with the ornithological results of which appear prominently the names of William E. Leach and Edward Sabine.

As illustrating the relation between Wilson and Bartram, which I have already pointedly mentioned, I may quote a few lines from Ord's "Life of Wilson."[1]

[1] "His school-house and residence being but a short distance from Bartram's Botanic Garden, situated on the west bank of the Schuylkill: a sequestered spot, possessing attractions of no ordinary kind; an acquaintance was soon contracted with that venerable naturalist, Mr. William Bartram, which grew into an uncommon friendship, and continued without the least abatement until severed by death. Here it was that Wilson found himself translated, if we may so speak, into a new existence. He had long been a lover of the works of Nature, and had derived more happiness from the contemplation of her simple beauties, than from any other source of gratification. But he had hitherto been a mere novice; he was now about to receive instructions from one whom the experiences of a long life, spent in travel and rural retirement, had rendered qualified to teach. Mr. Bartram soon perceived the bent of his friend's mind, and its congeniality to his own; and took every pains to encourage him in a study, which, while it expands the faculties, and purifies the heart, insensibly leads to the contemplation of the glorious Author of Nature himself. From his youth Wilson had been an observer of the manners of birds; and since his arrival in America he had found them objects of uncommon interest; but he had not yet viewed them with the eye of a naturalist."

This was about 1800 — rather a little later. Wilson's "novitiate" was the Vieillotian period, almost exactly. Bartram survived till July 22, 1823, his eighty-fourth year; the date of his death thus coinciding very nearly with the close of the Wilsonian epoch and period.

The Audubonian Epoch: 1824–1853.

(1824–1831.)

The Bonapartian Period. — A princely person, destined to die one of the most famous of modern naturalists — Charles Lucien Bonaparte, early conceived and executed the plan of continuing Wilson's work in similar style, if not in the same spirit. He began by publishing a series of "Observations on the Nomenclature of Wilson's Ornithology," in the "Journal" of the Philadelphia Academy, 1824–25, republished in an octavo volume, 1826. This valuable critical commentary introduced a new feature, — decided changes in nomenclature resulting from the sifting and rectification of synonymy. It is here that questions of synonymy — to-day the bane and drudgery of the working naturalist — first acquire prominence in the history of our special subject. There had been very little of it before, and Wilson himself, the least "bookish" of men, gave it scarcely any attention. Bonaparte also in 1825 added several species to our fauna upon material collected in Florida by the now venerable Titian R. Peale, — whose honored name is thus the first of those of men still living to appear in these annals. Bonaparte's "American Ornithology," uniform with "Wilson," and generally incorporated therewith in subsequent editions, as a continuation of Wilson's work, was originally published in four large quarto volumes, running 1825–33. The year 1827, in the midst of this work of Bonaparte's, was a notable one in several particulars. Bonaparte himself was very busy, producing a "Catalogue of the Birds of the United States," which, with a "Supplement," raised the number of species to 366, and of genera to 83; nearly a hundred species having been thus become known to us since Ord laid aside the pen that Wilson had dropped. William Swainson the same year described a number of new Mexican species and genera, many of which come also into the "North American" fauna. But the most notable event of the year was the appearance of the first five parts of Audubon's elephant folio plates. In 1828–29, as may also be noted, Ord brought out his three-vol. 8vo edition of Wilson. In 1828, Bonaparte returned to the charge of systematically cataloguing the birds of North America, giving now 382 species; and about this time he also produced a comparative list of the birds of Rome and Philadelphia. His main work having been completed in 1833, as just said, Bonaparte continued his labors with a "Geographical and Comparative List of the Birds of Europe and North America," published in London in 1838. This brochure gives 503 European and 471 American species. The celebrated zoölogist wrote until 1857, but his connection with North American birds was only incidental after 1838. The period here assigned him, 1824–1831, may seem too short: but this was the opening of the Audubonian epoch — a period of brilliant inception, and one in which events that were soon to mature their splendid fruit came crowding fast; so that room must be made at once for others who were early in the present epoch.

(1831–1832.)

The Swainsonio-Richardsonian Period. — The "Fauna Boreali-Americana," the ornithological volume of which was published in 1831, made an impression so indelible that a period, albeit a brief one, must be put here. The technic of this celebrated

treatise, more valuable for its descriptions of new species and genera than for its methods of classification, was by William Swainson, as were the elegant and accurate colored plates; the biographical matter, by Dr. (later Sir) John Richardson, increased our knowledge of the life-history of the northerly birds so largely, that it became a fountain of facts to be drawn upon by nearly every writer of prominence from that day to this. Each of the distinguished authors had previously appeared in connection with our birds, — Swainson as above said; Richardson in 1825, in the appendix to Captain Parry's "Journal." The influence of the work on the whole cannot be well overstated.

Two events, besides the appearance of the "Fauna," mark the year 1831. One of these is the publication of the first volume of Audubon's "Ornithological Biography," being the beginning of the text belonging to his great folio plates. The other is the completion of the bird-volumes of Peter Pallas' famous "Zoographia Rosso-Asiatica," one of the most important contributions ever made to our subject, treating so largely as it does of the birds of the region now called Alaska. The same year saw also the Jameson edition of "Wilson and Bonaparte."

(1832–1834.)

The Nuttallian Period.—Thomas Nuttall (born 1786—died 1859) was rather botanist than ornithologist; but the travels of this distinguished English-American naturalist made him the personal acquaintance of many of our birds, his love for which bore fruit in his "Manual of the Ornithology of the United States and Canada," of which the first volume appeared in 1832, the second in 1834. The work is notable as the first "handbook" of the subject; it possesses an agreeable flavor, and I think was the first formal treatise, excepting Wilson's, to pass to a second edition, as it did in 1840. Nuttall's name is permanent in our annals; and many years after he wrote, the honored title was chosen to be borne by the first distinctively ornithological association of this country, — the "Nuttall Ornithological Club," founded at Cambridge in 1873, and still flourishing.

(1834–1853.)

The Audubonian Period. — Meanwhile, the incomparable work of Audubon — "the greatest monument erected by art to nature" — was steadily progressing. The splendid genius of the man, surmounting every difficulty and discouragement of the author, had found and claimed its own. That which was always great had come to be known and named as such, victorious in its impetuous yet long-enduring battle with that curse of the world, — I mean the commonplace; the commonplace, with which genius never yet effected a compromise, since genius is necessarily a perpetual menace to mediocrity. Audubon and his work were one; he lived in his work, and in his work will live forever. When did Audubon die. We may read, indeed, "on Thursday morning, January 27th, 1851, when a deep pallor overspread his countenance. . . . Then, though he did not speak, his eyes, which had been so long nearly quenched, rekindled with their former lustre and beauty; his spirit seemed to be conscious that it was approaching the Spirit-land." And yet there are those who are wont to exclaim, "a soul! a soul! what is that?" Happy indeed are they who are conscious of its existence in themselves, and who can see it in others, every instant of time during their lives!

Audubon's first publication, perhaps, was in 1826, — an account of the Turkey-buzzard, in the "Edinburgh New Philosophical Journal," and some other minor notices came from his pen. But his energies were already focused on his life-work, with that intense and perfect absorption of self which only genius knows. The first volume of the magnificent folio plates, an hundred in number, appeared in 1827–30, in five parts; the second, in 1831–34, of the same number of plates; the third, in 1834–35, likewise of the same number of plates; the whole series of 4 volumes, 87 parts, 435 plates and 1065 figures of birds, being completed in June, 1839. Meanwhile, the text of the "Birds of America," entitled "Ornithological Biography," was steadily progressing, the first of these royal octavo volumes appearing in 1831, the fifth and last in 1839. In this latter year also appeared the "Synopsis of the Birds of North America," a single handy volume serving as a systematic index to the whole work. In 1840–44 appeared the standard octavo edition in seven volumes, with the plates reduced to octavo size and the text rearranged systematically; with a later and better nomenclature than that given in the "Ornithological Biography," and some other changes, including an appendix describing various new species procured during the author's journey to the upper Missouri in 1843. In the original elephant folios there were 435 plates; with the reduction in size the number was raised to 483, by the separation of various figures which had previously occupied the same plate; and to these 17 new ones were added, making 500 in all. The species of birds treated in the "Synopsis" are 491 in number; those in the work, as it finally left the illustrious author's hands, are 506 in number, nearly all of them splendidly figured in colors.

In estimating the influence of so grand an accomplishment as this, we must not leave Audubon "alone in his glory." Vivid and ardent was his genius; matchless he was both with pen and pencil in giving life and spirit to the beautiful objects he delineated with passionate love; but there was a strong and patient worker by his side, — William Macgillivray, the countryman of Wilson, destined to lend the sturdy Scotch fibre to an Audubonian epoch. The brilliant French-American naturalist was little of a "scientist." Of his work, the magical beauties of form and color and movement are all his; his page is redolent of Nature's fragrance: but Macgillivray's are the bone and sinew, the hidden anatomical parts beneath the lovely face, the nomenclature, the classification, — in a word, the technicalities of the science. Not that Macgillivray was only a closet-naturalist; he was a naturalist in the best sense — in every sense — of the word, and the "vital spark" is gleaming all through his works upon British birds, showing his intense and loyal love of Nature in all her moods. But his place in the Audubonian epoch in American ornithology is as has been said. The anatomical structure of American birds was first disclosed in any systematic manner, and to any considerable extent, by him. But only to-day, as it were, is this most important department of ornithology assuming its rightful place; and have we a modern Macgillivray to come?

The sensuous beauty with which Audubon endowed the object of his life was long in acquiring, with loss of no comeliness, the aspect more strict and severe of a later and maturer epoch. Audubon was practically accomplished in 1844, the year which saw his completed work; but I note no special or material change in the course of events, — no name of assured prominence, till 1853, when a new régime, that had meanwhile been

insensibly established, may be considered to have closed the Audubonian epoch, — the Audubonian period thus extending through the nine years after 1844.

While Audubon was finishing, several mentionable events occurred. I have already spoken of Bonaparte's "List" of 1838, and of the 1840 edition of Nuttall's "Manual." Richardson in 1837 contributed to the Report of the Sixth Meeting of the British Association for the Advancement of Science an elaborate and important "Report on North American Zoölogy," relating in due part to birds. The distinguished Danish naturalist, Reinhardt, wrote a special treatise on Greenland Birds, 1838; W. B. O. Peabody one upon the birds of Massachusetts, 1839. The important Zoölogy of Captain Beechey's Voyage appeared in 1839, with the birds done by N. A. Vigors. Maximilian, Prince of Wied, published his "Reise in das Innere Nord-America" in 1839–41. Sixteen new species of birds from Texas were described and figured by J. P. Giraud in 1841, and the same author's useful "Birds of Long Island" was published in 1844. This year saw also the bird-volume of De Kay's "Zoölogy of New York." The Rev. J. H. Linsley furnished a notable catalogue of the birds of Connecticut in 1843. A name intimately associated with Audubon's is that of J. K. Townsend, whose fruitful travels in the West in company with Nuttall in 1834 resulted in adding to our list the many new species which were published by Townsend himself in 1837, and also utilized by Audubon. Townsend's "Narrative" of his journey appeared in 1839; and the same year saw the beginning of a large work which Townsend projected, an "Ornithology of the United States," which, however, progressed no further than one part or number, being killed by the octavo edition of Audubon. In 1837 I first find the name of a friend of Audubon which often appears in his work — that of Dr. Thomas Mayo Brewer, who wrote on the birds of Massachusetts in this year, and in 1840 brought out his useful and convenient duodecimo edition of "Wilson," in one volume. In 1844, Audubon's last effectual year, the brothers Wm. M. and S. F. Baird appear, with a list of the birds of Carlisle, Pennsylvania, having the year previously, in July, 1843, described two new species of flycatchers, in the first paper ever written by the one who was to make the succeeding epoch; and it is significant that the last bird in Audubon's work was named "*Emberiza bairdii*."

Such were the aspects of the ornithological sky as the glorious Audubonian sun approached and passed the zenith; still more significant were the signs of the times as that orb neared its golden western horizon. In the interval between 1844 and 1853, Baird and Brewer continued; Cassin and Lawrence appeared in various papers; and round these names are grouped those of William Gambel, with new and interesting observations in the Southwest; of George A. McCall and S. W. Woodhouse, in the same connection; and of Holböll in respect of Greenland birds. The most important contributions were the several papers published by Gambel, in 1845 and subsequently, and Baird's Zoölogy of Stansbury's Expedition, 1852. But no period-marking, still less epoch-making, work accelerated the setting of the sun of Audubon.

The Bairdian Epoch: 1853–18 —.

(1853–1858.)

The Cassinian Period. — While much material was accumulating from the exploration of the great West, and the Bairdian period was rapidly nearing; while Brewer and

Lawrence were continuing their studies and writings, and many other names of lesser note were contributing their several shares to the whole result: the figure of John Cassin stands prominent. Cassin was born September 6, 1813, and passed from view in the Quaker City, January 10, 1869. Numerous valuable papers and several important works attest the assiduity and success with which he cultivated his favorite science to the end of his days. I think that his first paper was the description of a new hawk, *Cymindis wilsoni*, in 1847. Among his most important works are the Ornithology of the Wilkes Exploring Expedition; of the Perry Japan Expedition; and of the Gilliss Expedition to Chili. Aside from his strong coöperation with Baird in the great work to be presently noticed, Cassin's seal is set upon North American ornithology in the beautiful book begun in 1853 and finished in 1856, entitled "Illustrations of the Birds of California," etc., forming a large octavo volume, illustrated with fifty colored plates. His distinctive place in ornithology is this: he was the only ornithologist this country has ever produced who was as familiar with the birds of the Old World as with those of America. Enjoying the facilities of the then unrivalled collection of the Philadelphia Academy, his monographic studies were pushed into almost every group of birds of the world at large. He was patient and laborious in the technic of his art, and full of book-learning in the history of his subject; with the result, that the Cassinian period, largely by the work of Cassin himself, is marked by its "bookishness," by its breadth and scope in ornithology at large, and by the first decided change since Audubon in the aspect of the classification and nomenclature of the birds of our country. The Cassinian period marks the culmination of the changes that wrought the fall of the Audubonian sceptre in all that relates to the technicalities of the science, and consequently represents the beginning of a new epoch.

The peers of this period are only three, — Lawrence, Brewer, and Baird. The former of these, already an eminent ornithologist, continued his rapidly succeeding papers and was preparing his share of Baird's great work of 1858; though later his attention became so closely fixed upon the birds of Central and South America, that a "Lawrencian period" is to be found in the history of the ornithology of those countries rather than of our own. Dr. Brewer's various articles appeared, and in 1857 this author, so well known since Audubonian times, became the recognized leading oölogist of North America, through the publication of the first part of his "North American Oölogy" — a work unfortunately suspended at this point. Though thus fragmentary, this quarto volume stands as the first systematic treatise published in this country exclusively devoted to oölogy, and giving a considerable series of colored illustrations of eggs. But a larger measure of the world's regard became his much later, when, in 1874, appeared the great "History of North American Birds," in three quarto volumes, all the biographical matter of which was by him; and, even as I write, two more volumes are about to appear, in which he has like large share. Thus closely is the name of Brewer identified with the progress of the science for nearly half a century, — from 1837 at least, to 1884, some four years after his death, which occurred January 23, 1880. He was born in Boston, November 21, 1814.

Baird published little during the Cassinian period, being then intent upon the great work about to appear; but the number of workers in special fields attests the activity of the times. S. W. Woodhouse published his completed observations upon the birds of the Southwest in an illustrated octavo volume. Zadock Thompson's "Natural History

of Vermont" (1853) paid attention to the birds of that state. Birds of Wisconsin were catalogued by P. R. Hoy; of Ohio, by M. C. Read and Robert Kennicott; of Illinois, by H. Pratten; of Indiana, by R. Haymond; of Massachusetts, by F. W. Putnam; and various other "faunal lists" and local annotations appeared, including President Jefferson's Virginian ornithology, three-quarters of a century out of date. Dr. T. C. Henry and Dr. A. L. Heermann wrote upon birds of the Southwest; Reinhardt continued observations on Greenland birds; Dr. Henry Bryant published some valuable papers. The since very eminent English ornithologist, Dr. P. L. Sclater, appeared during this period in the present connection. The series of Pacific Railroad Reports, which were to culminate, so far as ornithology is concerned, with the famous ninth volume, were in progress; the sixth volume, containing Dr. J. S. Newberry's valuable and interesting article upon the birds of California and Oregon, was published in 1857. Thus the Cassinian period, besides being marked as already said in its broader features, was notable in its details for the increase in the number of active workers, the extent and variety of their independent observations, and the consequent accumulation of materials ready to be worked into shape and system.

(1858–18—.)

The Bairdian Period. — The ninth volume of the "Pacific Railroad Reports" was an epoch-making work, bearing the same relation to the times that the respective works of Audubon and Wilson had sustained in former years. A great amount of material — not all of which is more than hinted at in the foregoing paragraph — was at the service of Professor Baird. In the hands of a less methodical, learned, and sagacious naturalist, — of one less capable of elaborating and systematizing, — the result would probably have been an ordinary official report upon the collections of birds secured during a few years by the naturalists of the several explorations and surveys for a railroad route from the Mississippi Valley to the Pacific Ocean. But having already transformed the eighth volume of the Reports from such a "public document" into a systematic treatise on North American Mammals, this author did the same for the birds of North America, with the coöperation of Cassin and Lawrence. This portly quarto volume, published in 1858, represents the most important and decided single step ever taken in North American ornithology in all that relates to the technicalities of the science. It effected a revolution — one already imminent in consequence of Cassin's studies — in classification and nomenclature, nearly all the names of our birds which had been in use in the Audubonian epoch being changed in accordance with more modern usages in generic and specific determinations. While the work contains no biographical matter, — nothing of the life-history of birds, it gives lucid and exact diagnoses of the species and genera known at the time, with copious synonymy and critical commentary. Various new genera are characterized, and many new species are described. The influence of the great work was immediate and widespread, and for many years the list of names of the 738 species contained in the work remained a standard of nomenclature from which few desired or indeed were in position to deviate. The value of the work was further enhanced in 1860 by its republication, identical in the text, but with the addition of an atlas of 100 colored plates. Many of these plates were the same as those which had appeared in other volumes of the Pacific Railroad Reports, notably the sixth and tenth

and twelfth (the two latter volumes having appeared in 1859); others were those contained in the "Mexican Boundary Report" which had appeared under Professor Baird's editorship in 1859; about half of them were new.

I have spoken of the collaboration of Cassin and Lawrence in the production of this remarkable treatise. Considering it only as one of a series of reports upon the Pacific Railroad Surveys, I should bring into somewhat of association the names of those who contributed the ornithological portions of other volumes, as the fourth, sixth, tenth, and twelfth, — Dr. C. B. R. Kennerly, Dr. J. S. Newberry, Dr. A. L. Heermann, Dr. J. G. Cooper, and Dr. George Suckley. Nor should it be forgotten that numberless other collectors and contributors, whose specimens are catalogued throughout the volume, brought their hands to bear upon the erection of this grand monument.

But what of the genius of this work? — for I have not measured my words in speaking of Wilson and Audubon. Can any work be really great without that mysterious quality? Certainly not. This work is instinct with the genius of the times that saw its birth. This work is the spirit of an epoch embodied.

But here I must pause. My little sketch is brought upon the threshold of contemporaneous history, — to the beginning of the Bairdian period, of the close of which, as of the duration of the Bairdian epoch, it is not for me to speak. When the splendid achievements of American ornithologists during the past quarter of a century shall be seen in historical perspective; when the brilliant possibilities of our near future shall have become the realizations of a past: when the glowing names that went before shall have fired another generation with a noble zeal, a lofty purpose, and a generous emulation — then, perhaps, the thread here dropped may be recovered by another hand.

Yet a few words of Preface proper to the present work appear to be required. The original edition of the "Key" was published in October, 1872, in an issue of about 2,200 copies. It was not stereotyped, and has been for some years entirely out of print. It formed an imperial octavo of 361 pages, illustrated with 238 woodcuts in the text and 6 steel plates. It was designed as a manual or text-book of North American Ornithology. To meet this design, the Introduction consisted of a general account of the external characters of birds, an explanation of the technical terms used in describing them, and some exposition of the leading principles of classification and nomenclature. An artificial "key" or analysis of the genera, constructed upon a plan found practically useful in botany, but seldom applied to zoölogy, was introduced, to enable one who had some knowledge of the technical terms to refer a given specimen to its proper genus. Then, in the body of the work, each species was briefly described, with indication of its geographical distribution and references to several leading authorities. The families and orders of North American birds were also characterized, and a synopsis of the fossil birds was appended. The work introduced many decided changes in classification and nomenclature which the then state of the science seemed to require, and systematically recognized a large number of those subspecies or geographical races which are now indicated by the use of trinomial nomenclature, — a method now fully established and recognized as peculiar to the "American school." The central idea of the treatise was to enable one

to identify and label his specimens, though he might have no other knowledge of ornithology than such as the book itself gave him. I have been given to understand that the work has answered its purpose, and has had a useful career; and I have long since been advised by my esteemed publishers that they were ready to issue a second edition, which I have only just now found time to complete.

The present edition of the "Key" is conceived in the same spirit as the former one, to fulfil precisely the same purpose. But it has been entirely rewritten, and is quite another work, though the old title is preserved. An author who practises his profession diligently for twenty years is apt to find fault with his first book, and seek to remedy its defects when opportunity offers. It has become quite clear to me, as it doubtless has to others, that the old "Key" no longer turns in the lock with ease and precision, — not that it has rusted from disuse, but that the more complicated mechanism of the lock requires its key to be refitted. During no previous period has our knowledge gone faster or farther or more surely than in the interval between the two editions of the "Key;" there are scores of active and enthusiastic workers where there was one before; scores of important treatises have appeared; the literature of the subject has been searched, sifted, and systematized; every corner of our country has been ransacked for birds, and the list of our species and subspecies has reached about 900 by the many late discoveries; active interest in this branch of science is no longer confined to professed ornithologists; the importance of avian anatomy is as fully recognized as is the beauty of the life-history of birds; a distinctively American school of ornithology has grown up, introducing radical changes in nomenclature and classification; a quarterly journal of ornithology has reached its ninth annual volume; an American Ornithologists' Union, the membership of which extends to every quarter of the globe, has been founded.

So rapid, indeed, has been the progress, and so radical the changes wrought during the last few years, that I doubt not this is the time to take our bearings anew and proceed with judicious conservatism. Neither do I doubt that just at this moment a new departure is imminent, hinging upon the establishment of the American Ornithologists' Union. It behooves us, therefore, to consider the question, not alone of where we stand to-day, but also, of whither we are tending; for we are certainly in a transition state, and not even the near future can as yet be accurately forecast. The pliability and elasticity of our trinomial system of nomenclature is very great; and the method lends itself so readily to the nicest discriminations of geographical races, — of the finest shades of variation in subspecific characters with climatic and other local conditions of environment, that our new toy may not impossibly prove a dangerous instrument, if it be not used with judgment and caution. We seem to be in danger of going too far, if not too fast, in this direction. It is not to cry "halt!" — for any advance is better than any standstill; but it is to urge prudence, caution, and circumspection, lest we be forced to recede ingloriously from an untenable position, — that these words are penned, with a serious sense of their necessity.

In the present unsettled and perplexing state of our nomenclature, when appeal to no "authority" or ultimate jurisdiction is possible, it is well to formulate and codify some canons of nomenclature by which to agree to abide. It is well to apply such canons rigidly, with thorough sifting of synonymy, no matter what precedents be disregarded, what innovations be caused. It is well to use trinomials for subspecific determinations. But it is not well to overdo the "variety business;" feather-splitting is

no better than hair-splitting, and the liberties of the "American idea" must never degenerate into license. Our action in this regard must stop short of a point where an unfavorable reaction would be the inevitable result.

But I have digressed, in saying a warning word, from the point of the conclusion of this Preface, which is simply to describe the new edition of the "Key" with special reference to its difference from the former one. The classification and nomenclature are materially different, in consequence of the progress of our knowledge during the past twelve years. In 1873, a year after the old "Key" appeared, I published a "Check List," conformed exactly with the nomenclature of the "Key." In 1882, when I had recast the "Key," I published a second edition of the "Check List" in conformity with the new "Key." The present work, therefore, gives the same names, with scarcely any variance, though with a few additional ones; the new "Check List" and the new "Key" being practically one in all that pertains to nomenclature, and representing a particular phase of the subject. The numbering of the species, also, corresponds with that in the "Check List."

Part I. of the present work consists of my "Field Ornithology," originally published as a separate treatise in 1874, and now for the first time incorporated with the "Key." It is reprinted nearly verbatim, but with some little amplification towards its end, and the introduction of a few illustrations.

Part II. consists of the introductory matter of the old "Key," very greatly amplified. In its present shape it is a sort of "Closet Ornithology" as distinguished from a "Field Ornithology;" being a treatise on the classification and structure of birds, explaining and defining the technical terms used in ornithology, — in short, teaching the principles of the science and illustrating their application.

Part III., the main body of the work, describes all the species and subspecies of North American birds known to me, defines the genera, and characterizes the families and higher groups. The descriptions are much more elaborate than those of the old "Key," and I trust that such amplification has been made without loss of that sharpness of definition which was the aim of the first edition. I have kept steadily in view my main purpose — the ready identification of specimens. In many cases I have drawn upon my other works — such as the "Birds of the Colorado Valley," the "Birds of the Northwest," and several of my Monographs, — for available ready-made descriptions; but for the most part the matter of this kind is new. Scarcely any of this part of the old "Key" remains as it was. One improvement, I think, will be found in the removal of the unnecessary references to authorities which closed the descriptive paragraphs of the old "Key," and the utilization of the space thus gained by introducing terse biographical items, with special reference to nests and eggs, to song, flight, migrative and other habits; the technical descriptions of the species thus also epitomizing the life-history of the birds. Geographical distribution is also more fully treated, as its importance deserves. More attention has been paid to the description of the plumages of females and young birds. The specific names head their respective paragraphs, instead of tailing-off the same; they are also marked for accent, and their etymology is concisely stated, — though for this matter the student should continue to use the new "Check List."

As regards the artificial "key to the genera" of the old work, it has proven that too much was attempted in undertaking to carry the student at once to our refined modern genera. I have accordingly substituted artificial keys to the orders and families;

and throughout the work have analyzed species under their respective genera, these under their subfamilies or families, and these again under their orders.

Part IV. consists of a Synopsis of the Fossil birds of North America, corresponding to the appendix of the old "Key," but augmented by later discoveries. As before, this part of the work has been revised by Professor O. C. Marsh.

In the mechanical execution of the work, it has been my aim to compress the most matter into the least space and leave no waste paper, in order to keep the treatise within a single portable volume of convenient text-book size. I judge that there is nearly four times as much matter in the present volume as there was in the original edition, the page being much more closely printed, in a smaller type, and on thinner paper.

The old "Key" was insufficiently illustrated, and the average character of the cuts was not entirely satisfactory. The present edition more than doubles the number of illustrations. These are in part original, in part derived from various sources, all of which are duly accredited in the text. The basis of the series is of course the cuts of the former edition; but many of these have been discarded and replaced by better ones. About fifty of the most effective engravings were secured by my publishers from Brehm's "Thierleben;" nearly as many more are from Dixon's "Rural Bird Life," the American edition of which is owned by the same firm. A few have been copied from D. G. Elliot's "Birds of America," and a few others from the Proceedings of the Zoölogical Society of London. About fifty of the prettiest ones were drawn by Mr. Edwin Sheppard and engraved by Mr. H. H. Nichols, expressly for this edition. Another set — how many there are of them I do not know — are from my own drawings, and have mostly appeared in other of my publications. Several of Mr. R. Ridgway's drawings have been placed at my service, through his kind attentions, and with Professor Baird's permission. I am indebted to Dr. R. W. Shufeldt, U. S. A., for about thirty original anatomical drawings, as well as for the colored frontispiece. Mr. Henry W. Elliott has kindly put at my disposition several of his own artistic compositions, and I have received some very beautiful engravings with the compliments of the Century Company of New York.

It is always agreeable to pay one's respects when due, and acknowledge assistance and encouragement received in the preparation of one's books. Yet what an embarrassment is mine now! For there is no writer of repute on North American ornithology, and scarcely a leader of the science at large, who has not assisted in the making of the "Key;" and there is no reader of the work who has not encouraged its author to produce this new edition. I am trebly in debt, — to thousands whose names I know not; to hundreds I only know by name and fame; to scores of tried and trusted friends.

But let me say how much I am indebted to my compositors and proof-readers of the University Press at Cambridge for the skill with which they have turned copy into print, and to the proprietors of that justly-celebrated establishment for the pains they have taken in making the book an example of beautiful and accurate typography. Let me recognize here the liberality and generosity of my friend, Mr. Dana Estes, senior of the firm of Estes and Lauriat, in permitting me to make the book to suit myself, and in sparing no expense to which he might be put in consequence. Let me not forget that during its preparation, as for many years previously, I have enjoyed to the fullest extent the privileges of the Smithsonian Institution and the National Museum, through the courtesy of Professor Baird, my access to the great collection of birds being always facili

tated by the attentions of Mr. Robert Ridgway, the Curator of Ornithology. And may that less tangible but not less real source of strength which inheres in the sympathetic and genial intercourse of a lifetime continue to be mine to draw upon, for all my works, from my warm friend, J. A. Allen, the first President of the American Ornithologists' Union.

"Prefaces," says some one, "ever were and still are but of two sorts; . . . still the author keeps to his old and wonted method of prefacing, when, at the beginning of his book he enters, either with a halter about his neck, submitting himself to his reader's mercy whether he shall be hanged, or no; or else in a huffing manner he appears with the halter in his hand, and threatens to hang his reader, if he gives him not his good word." But I wish neither to hang nor be hanged; I wish the work were better than it is, for my reader's sake; I wish the author were better than he is, for my own sake; and above all I wish that every author may rise superior to his best work, to the end that the man himself be judged above his largest achievements. It is well to do great things, but better still to be great.

E. C.

Smithsonian Institution,
Washington, D. C., April, 1884.

Part I.

FIELD ORNITHOLOGY:

BEING A

MANUAL OF INSTRUCTION FOR COLLECTING, PREPARING, AND PRESERVING BIRDS.

FIELD ORNITHOLOGY must lead the way to Systematic and Descriptive Ornithology. The study of Birds in the field is an indispensable prerequisite to their study in the library and the museum. Directions for observing and collecting birds, for preparing and preserving them as objects of natural history, will greatly help the student on his way to become a successful Ornithologist, if he will faithfully and intelligently observe them. It is believed that the practical Instructions which the author has to give will, if followed out, enable any one who has the least taste or aptitude for such pursuits to become proficient in the necessary qualifications of the good working ornithologist. These instructions are derived from the writer's own experience, reaching in time over twenty years, and extending in area over large portions of North America. Having made in the field the personal acquaintance of most species of North American birds, and having shot and skinned with his own hands several thousand specimens, he may reasonably venture to speak with confidence, if not also with authority, respecting methods of study and manipulation. Feeling so much at home in the field, with his gun for destroying birds, and his instruments for preserving their skins, he wishes to put the most inexperienced student equally at ease; and therefore begs to lay formality aside, that he may address the reader familiarly, as if chatting with a friend on a subject of mutual interest.

§ 1. — IMPLEMENTS FOR COLLECTING, AND THEIR USE.

The Double-barrelled Shot Gun is your main reliance. Under some circumstances you may trap or snare birds, catch them with bird-lime, or use other devices; but such cases are exceptions to the rule that you will shoot birds, and for this purpose no weapon compares with the one just mentioned. The soul of good advice respecting the selection of a gun is, *Get the best one you can afford to buy;* go the full length of your purse in the matters of material and workmanship. To say nothing of the prime requisite, safety, or of the next most desirable quality, efficiency, the durability of a high-priced gun makes it cheapest in the end.

Style of finish is obviously of little consequence, except as an index of other qualities; for inferior guns rarely, if ever, display the exquisite appointments that mark a first-rate arm. There is really so little choice among good guns that nothing need be said on this score; you cannot miss it if you pay enough to any reputable maker or reliable dealer. But collecting is a specialty, and some guns are better adapted than others to your particular purpose, which is the destruction, as a rule, of small birds, at moderate range, with the least possible injury to their plumage. Probably three-fourths or more of the birds of a miscellaneous collection average under the size of a pigeon, and were shot within thirty yards. A *heavy* gun is therefore unnecessary, in fact ineligible, the extra weight being useless. You will find a gun of 7½ to 8 pounds weight most suitable. For similar reasons the *bore* should be small; I prefer 14 gauge, and should not think of going over 12. To judge from the best sporting authorities, *length of barrel* is of less consequence than many suppose; for myself, I incline to a rather long barrel, — one nearer 33 than 28 inches, — believing that such a barrel *may* throw shot better; but I am not sure that this is even the rule, while it is well known that several circumstances of loading, besides some almost inappreciable differences in the way barrels are bored, will cause guns apparently exactly alike to throw shot differently. Length and crook of *stock* should of course be adapted to your figure, — a gun may be made to fit you, as well as a coat. For wild-fowl shooting, and on some other special occasions, a heavier and altogether more powerful gun will be preferable.

Breech-Loader *vs.* **Muzzle-Loader**, a case long argued, may be considered settled in favor of the former. Provided the mechanism and workmanship of the breech be what they should, there are no valid objections to offset obvious advantages, some of which are these: ease and rapidity of loading, and consequently delivery of shots in quick succession; facility of cleaning; compactness and portability of ammunition; readiness with which different-sized shot may be used. This last is highly important to the collector, who never knows the moment he may wish to fire at a very different bird from such as he has already loaded for. The muzzle-loader must always contain the fine shot with which nine-tenths of your specimens will be secured; if in both barrels, you cannot deal with a hawk or other large bird with reasonable prospects of success; if in only one barrel, the other being more heavily charged, you are crippled to the extent of exactly one-half of your resources for ordinary shooting. Whereas, with the breech-loader you will habitually use mustard-seed in both barrels, and yet can slip in a different shell in time to seize most opportunities requiring large shot. This consideration alone should decide the case. But, moreover, the time spent in the field in loading an ordinary gun is no small item; while cartridges may be charged in your leisure at home. This should become the natural occupation of your spare moments. No time is really *gained;* you simply change to advantage the time consumed. Metal shells, charged with loose ammunition, and susceptible of being reloaded many times, may be used instead of any special fixed ammunition which, once exhausted in a distant place (and circumstances may upset the best calculations on that score), leaves the gun useless. On charging the shells mark the number of the shot used on the outside wad; or better, use colored wads, say plain white for dust shot, and red, blue, and green for certain other sizes. If going far away, take as many shells as you think can possibly be wanted — and a few more.

Experience, however, will soon teach you to prefer paper cartridges for breech-loaders. They may of course be loaded according to circumstances, with the same facility as metal shells, and even reloaded if desired. It is a good deal of trouble to take care of metal shells, to prevent loss, keep them clean, and avoid bending or indenting; while there is often a practical difficulty in recapping — at least with the common styles that take a special primer. Those fitted with a screw top holding a nipple for ordinary caps are expensive. Paper cart-

ridges come already capped, so that this bother is avoided, as it is not ordinarily worth while to reload them. They are made of different colors, distinguishing various sizes of shot used without employ of colored wads otherwise required. They may be taken into the field empty and loaded on occasion to suit; but it is better to pay a trifle extra to have them loaded at the shop. In such case, about four-fifths of the stock should contain mustard-seed, nearly all the rest about No. 7, a very few being reserved for about No. 4. Cost of ammunition is hardly appreciably increased; its weight is put in the most conveniently portable shape; the whole apparatus for carrying it, and loading the shells, is dispensed with; much time is saved, the entire drudgery (excepting gun-cleaning) of collecting being avoided. I was prepared in this way during the summer of 1873 for the heaviest work I ever succeeded in accomplishing during the same length of time. In June, when birds were plentiful, I easily averaged fifteen skins a day, and occasionally made twice as many. As items serving to base calculations, I may mention that in four months I used about two thousand cartridges, loaded, at $42 per M., with seven-eighths of an ounce of shot and two and three-fourths drachms of powder; only about three hundred were charged with shot larger than mustard-seed. In estimating the size of a collection that may result from use of a given number of cartridges, it may not be safe for even a good shot to count on much more than half as many specimens as cartridges. The number is practically reduced by the following steps: — Cartridges lost or damaged, or originally defective; shots missed; birds killed or wounded, not recovered; specimens secured unfit for preservation, or not preserved for any reason; specimens accidentally spoilt in stuffing, or subsequently damaged so as to be not worth keeping; and finally, use of cartridges to supply the table.

Other Weapons, etc. — An ordinary *single-barrel* gun will of course answer; but is a sorry makeshift, for it is sometimes so poorly constructed as to be unsafe, and can at best be only just half as effective. This remark does not apply to any of the fine single-barrelled breech-loaders now made. You will find them very effective weapons, and they are not at all expensive. An arm now much used by collectors is a kind of breech-loading pistol, with or without a skeleton gun-stock to screw into the handle, and taking a particular style of metal cartridge, charged with a few grains of powder, or with nothing but the fulminate. They are very light, very cheap, safe and easy to work, and astonishingly effective up to twenty or thirty yards; making probably the best "second choice" after the matchless double-barrelled breech-loader itself. The *cane-gun* should be mentioned in this connection. It is a single-barrel, lacquered to look like a stick, with a brass stopper at the muzzle to imitate a ferule, counter-sunk hammer and trigger, and either a simple curved handle, or a light gunstock-shaped piece that screws in. The affair is easily mistaken for a cane. Some have acquired considerable dexterity in its use; my own experience with it is very limited and unsatisfactory; the handle always hit me in the face, and I generally missed my bird. It has only two recommendations. If you approve of shooting on Sunday and yet scruple to shock popular prejudice, you can slip out of town unsuspected. If you are shooting where the law forbids destruction of small birds, — a wise and good law that you may sometimes be inclined to defy, — artfully careless handling of the deceitful implement may prevent arrest and fine. A *blow-gun* is sometimes used. It is a long slender tube of wood, metal, or glass, through which clay-balls, tiny arrows, etc., are projected by force of the breath. It must be quite an art to use such a weapon successfully, and its employment is necessarily exceptional. Some uncivilized tribes are said to possess marvellous skill in the use of long bamboo blow-guns: and such people are often valuable employés of the collector. I have had no experience with the noiseless *air-gun*, which is, in effect, a modified blow-gun, compressed air being the explosive power. Nor can I say much of various methods of *trapping* birds that may be practised. On these points I must leave you to your own devices, with the remark that horse-hair *snares*, set over a nest, are often of great

service in securing the parent of eggs that might otherwise remain *unidentified.* I have no practical knowledge of *bird-lime;* I believe it is seldom used in this country. A method of *netting* birds alive, which I have tried, is both easy and successful. A net of fine green silk, some 8 or 10 feet square, is stretched perpendicularly across a narrow part of one of the tiny brooks, overgrown with briers and shrubbery, that intersect many of our meadows. Retreating to a distance, the collector beats along the shrubbery making all the noise he can, urging on the little birds till they reach the almost invisible net and become entangled in trying to fly through. I have in this manner taken a dozen sparrows and the like at one "drive." But the gun can rarely be laid aside for this or any similar device.

Ammunition. — The best *powder* is that combining strength and cleanliness in the highest compatible degree. In some brands too much of the latter is sacrificed to the former. Other things being equal, a rather coarse powder is preferable, since its slower action tends to throw shot closer. Some numbers are said to be "too quick" for fine breech-loaders. Inexperienced sportsmen and collectors almost invariably use too coarse *shot.* When unnecessarily large, two evils result: the number of pellets in a load is decreased, the chances of killing being correspondingly lessened; and the plumage is unnecessarily injured, either by direct mutilation, or by subsequent bleeding through large holes. As already hinted, shot cannot be too fine for your routine collecting. Use "mustard-seed," or "dust-shot," as it is variously called; it is smaller than any of the sizes usually numbered. As the very finest can only be procured in cities, provide yourself liberally on leaving any centre of civilization for even a country village, to say nothing of remote regions. A small bird that would have been torn to pieces by a few large pellets, may be riddled with mustard-seed and yet be preservable; moreover, there is, as a rule, little or no bleeding from such minute holes, which close up by the elasticity of the tissues involved. It is astonishing what large birds may be brought down with the tiny pellets. I have killed hawks with such shot, knocked over a wood ibis at forty yards and once shot a wolf dead with No. 10, though I am bound to say the animal was within a few feet of me. After dust-shot, and the nearest number or two, No. 8 or 7 will be found most useful. Water-fowl, thick-skinned sea-birds, like loons, cormorants, and pelicans, and a few of the largest land birds, require heavier shot. I have had no experience with the substitution of fine gravel or sand, much less water, as a projectile; besides shot I never fired anything at a bird except my ramrod, on one or two occasions, when I never afterwards saw either the bird or the stick. The comparatively trivial matter of *caps* will repay attention. Breech-loaders not discharged with a pin take a particular style of short cap called a "primer;" for other guns the *best* water-proof lined caps will prevent annoyance and disappointment in wet weather, and may save you an eye, for they only *split* when exploded; whereas, the flimsy cheap ones — that "G D" trash, for instance, sold in the corner grocery at ten cents a hundred — usually fly to pieces. Cut felt *wads* are the only suitable article. Ely's "chemically prepared" wadding is the best. It is well, when using plain wads, occasionally to drive a greased one through the barrel. Since you may sometimes run out of wads through an unexpected contingency, always keep a wad-cutter to fit your gun. You can make serviceable wads of pasteboard, but they are inferior to felt. Cut them on the flat sawn end of a stick of firewood: the side of a plank does not do very well. Use a wooden mallet, instead of a hammer or hatchet, and so save your cutter. Soft paper is next best after wads; I have never used rags, cotton or tow, fearing these tinder-like substances might leave a spark in the barrels. Crumbled leaves or grass will answer at a pinch. I have occasionally, in a desperate hurry, loaded and *killed* without any wadding.

Other Equipments. — (*a.*) *For the Gun.* A gun-case will come cheap in the end, especially if you travel much. The usual box, divided into compartments, and well lined,

is the best, though the full length leather or india-rubber cloth case answers very well. The box should contain a small kit of tools, such as mainspring-vice, nipple-wrench, screw-driver, etc. A stout hard-wood cleaning rod, with wormer, will be required. It is always safe to have parts of the gun-lock, especially mainspring, in duplicate. For muzzle-loaders extra nipples and extra ramrod heads and tips often come into use. For breech-loaders the apparatus for charging the shells is so useful as to be practically indispensable. (*b.*) *For ammunition.* Metal shells or paper cartridges may be carried loose in the large lower coat pocket, or in a leather satchel. There is said to be a chance of explosion by some unlucky blow, when they are so carried, but I never knew of an instance. Another way is to fix them separately in a row in snug loops of soft leather sewn continuously along a stout waist-belt; or in several such horizontal rows on a square piece of thick leather, to be slung by a strap over the shoulder. But better than anything else is a stout linen *vest*, similarly furnished with loops holding each a cartridge; this distributes the weight so perfectly, that the usual "forty rounds" may be carried without feeling it. The appliances for loose ammunition are almost endlessly varied, so every one may consult his taste or convenience. But now that everybody uses the breech-loader, shot-pouches and powder-flasks are among the things that were. (*c.*) *For specimens.* You must always carry *paper* in which to wrap up your specimens, as more particularly directed beyond. Nothing is better for this purpose than writing-paper; "rejected" or otherwise useless MSS. may thus be utilized. The ordinary game bag, with leather back and network front, answers very well; but a light basket, fitting the body, such as is used by fishermen, is the best thing to carry specimens in. Avoid putting specimens into *pockets*, unless you have your coat-tail largely excavated: crowding them into a close pocket, where they press each other, and receive warmth from the person, will injure them. It is always well to take a little cotton into the field, to plug up shot-holes, mouth, nostrils, or vent, immediately, if required. (*d.*) *For Yourself.* The indications to be fulfilled in your clothing are these: Adaptability to the weather; and since a shooting-coat is not conveniently changed, while an overcoat is ordinarily ineligible, the requirement is best met by different underclothes. Easy fit, allowing perfect freedom of muscular action, especially of the arms. Strength of fabric, to resist briers and stand wear; velveteen and corduroy are excellent materials. Subdued color, to render you as inconspicuous as possible, and to show dirt the least. Multiplicity of pockets — a perfect shooting-coat is an ingenious system of hanging pouches about the person. Broad-soled, low-heeled boots or shoes, giving a firm tread even when wet. Close-fitting cap with prominent visor, or low soft felt hat, rather broad brimmed. Let india-rubber goods alone; the field is no place for a sweat-bath.

Qualifications for Success. — With the outfit just indicated you command all the required appliances that you can *buy*, and the rest lies with yourself. Success hangs upon your own exertions; upon your energy, industry, and perseverance; your knowledge and skill; your zeal and enthusiasm, in collecting birds, much as in other affairs of life. But that your efforts — maiden attempts they must once have been if they be not such now — may be directed to best advantage, further instructions may not be unacceptable.

To Carry a Gun without peril to human life or limb is the *a b c* of its use. "There's death in the pot." Such constant care is required to avoid accidents that no man can give it by continual voluntary efforts: safe carriage of the gun must become an unconscious habit, fixed as the movements of an automaton. The golden rule and whole secret is: *the muzzle must never sweep the horizon;* accidental discharge should send the shot into the ground before your feet, or away up in the air. There are several safe and easy ways of holding a piece: they will be employed by turns to relieve particular muscles when fatigued. 1. Hold it in the hollow of the arm (preferably the left, as you can recover to aim in less time than from the

right), across the front of your person, the hand on the grip, the muzzle elevated about 45°. 2. Hang it by the trigger guard hitched over the forearm brought round to the breast, the stock passing behind the upper arm, the muzzle pointing to the ground a pace or so in front of you. 3. Shoulder it, the hand on the grip or heel-plate, the muzzle pointing upward at least 45°. 4. Shoulder it reversed, the hand grasping the barrels about their middle, the muzzle pointing forward and downward: this is perfectly admissible, but is the most awkward position of all to recover from. *Always carry a loaded gun at half-cock*, unless you are about to shoot. Most good guns are now fitted with rebounding locks, an arrangement by which the hammer is thrown back to half-cock as soon as the blow is delivered on the pin. This admirable device is a great safe-guard, and is particularly eligible for breech-loaders, as the barrels may be unlocked and relocked without touching the hammers. Unless the lock fail, accidental discharge is impossible, except under these circumstances: *a*, a direct blow on the nipple or pin; *b*, catching of both hammer and trigger simultaneously, drawing back of the former and its release whilst the trigger is still held, — the chances against which are simply incalculable. Full-cock, ticklish as it seems, is safer than no-cock, when a tap on the hammer or even the heel-plate, or a slight catch and release of the hammer, may cause discharge. Never let the muzzle of a loaded gun point toward your own person for a single instant. Get your gun over fences, or into boats or carriages, before you get over or in yourself, or at any rate no later. Remove caps or cartridges on entering a house. Never aim a gun, loaded or not, at any object, unless you mean to press the trigger. Never put a loaded gun away long enough to forget whether it is loaded or not; never leave a loaded gun to be found by others under circumstances reasonably presupposing it to be unloaded. Never put a gun where it can be knocked down by a dog or a child. Never imagine that there can be any excuse for *leaving* a breech-loader loaded under any circumstances. Never forget that the idiots who kill people because they "did n't know it was loaded," are perennial. Never forget that though a gunning accident may be sometimes interpreted (from a certain standpoint) as a "dispensation of Providence," such dispensations happen oftenest to the careless.

To Clean a Gun properly requires some knowledge, more good temper, and most "elbow-grease;" it is dirty, disagreeable, inevitable work, which laziness, business, tiredness, indifference, and good taste will by turns tempt you to shirk. After a hunt you are tired, have your clothes to change, a meal to eat, a lot of birds to skin, a journal to write up. If you "sub-let" the contract the chances are it is but half fulfilled; serve yourself, if you want to be well served. If you cannot find time for a regular cleaning, an intolerably foul gun may be made to do another day's work by swabbing for a few moments with a wet (not dripping) rag, and then with an oiled one. For the full wash use cold water first; it looseus dirt better than hot water. Set the barrels in a pail of water; wrap the end of the cleaning rod with tow or cloth, and pump away till your arms ache. Change the rag or tow, and the water too, till they both stay clean for all the swabbing you can do. Fill the barrels with boiling water till they are well heated; pour it out, wipe as dry as possible inside and out, and set them by a fire. Finish with a *light* oiling, inside and out; touch up all the metal about the stock, and polish the wood-work. Do not remove the locks oftener than is necessary; every time they are taken out, something of the exquisite fitting that marks a good gun may be lost; as long as they work smoothly take it for granted they are all right. The same direction applies to nipples. To keep a gun well, under long disuse, it should have had a particularly thorough cleaning; the chambers should be packed with greasy tow; greased wads may be rammed at intervals along the barrels; or the barrels may be filled with melted tallow. Neat's-foot is recommended as the best easily procured oil; porpoise-oil which is, I believe, used by watch-makers, is the very best; the oil made for use on sewing-machines is excellent; "olive" oil

(made of lard) for table use answers the purpose. The quality of any oil may be improved by putting in it a few tacks, or scraps of zinc, — the oil expends its rusty capacity in oxidizing the metal. Inferior oils get "sticky." One of the best preventives of rust is mercurial ("blue") ointment: it may be freely used. Kerosene will remove rust; but use it sparingly for it "eats" sound metal too.

To Load a Gun effectively requires something more than knowledge of the facts that the powder should go in before the shot, and that each should have a wad a-top. Probably the most nearly universal fault is use of too much shot for the amount of powder; and the next, too much of both. The rule is *bulk for bulk* of powder and shot. If not exactly this, then rather less shot than powder. It is absurd to suppose, as some persons who ought to know better do, that the more shot in a gun the greater the chances of killing. The projectile force of a charge cannot possibly be greater than the *vis inertiæ* of the gun as held by the shooter. The explosion is manifested in all directions, and blows the shot one way simply and only because it has no other escape. If the resistance in front of the powder were greater than elsewhere, the shot would not budge, but the gun would fly backward, or burst. This always reminds me of Lord Dundreary's famous conundrum — Why does a dog wag his tail? Because he is bigger than his tail; otherwise the tail would wag *him.* A gun shoots shot because the gun is the heavier; otherwise the shot would shoot the gun. Every unnecessary pellet is a pellet against you, not against the game. The experienced sportsman uses about one-third less shot than the tyro, with proportionally better result, other things being equal. As to powder, moreover, a gun can only burn just so much, and every grain blown out unburnt is wasted if nothing more. No express directions for absolute weight or measures of either powder or shot can be given; in fact, different guns take as their most effective charge such a variable amount of ammunition, that one of the first things you have to learn about your own arm is, its normal charge-gauge. Find out, by assiduous target practice, what absolute amounts (and to a slight degree, what relative proportion) of powder and shot are required to shoot the furthest and distribute the pellets most evenly. This practice, furthermore, will acquaint you with the gun's capacities in every respect. You should learn exactly what it will and what it will not do, so as to feel perfect confidence in your arm within a certain range, and to waste no shots in attempting miracles. Immoderate recoil is a pretty sure sign that the gun was overloaded, or otherwise wrongly charged; and all force of recoil is subtracted from the impulse of the shot. It is useless to ram powder very hard; two or three smart taps of the rod will suffice, and more will not increase the explosive force. On the shot the wad should simply be pressed close enough to fix the pellets immovably. All these directions apply to the charging of metal or paper cartridges as well as to loading by the muzzle. The latter operation is so rarely required, now that guns of every grade break at the breach, that advice on this score may seem quite anachronistic; nevertheless, I let what I said in the original edition stand. When about to recharge one barrel see that the hammer of the other stands at half-cock. Do not drop the ramrod into the other barrel, for a stray shot might impact between the swell of the head and the gun and make it difficult to withdraw the rod. During the whole operation keep the muzzle as far from your person as you conveniently can. Never force home a wad with the flat of your hand over the end of the rod, but hold the rod between your fingers and thumb; in case of premature explosion, it will make just the difference of lacerated finger tips, or a blown-up hand. Never look into a loaded gun-barrel; you might as wisely put your head into a lion's mouth to see what the animal had for dinner. After a miss-fire hold the gun up a few moments and be slow to reload; the fire sometimes "hangs" for several seconds. Finally, let me strongly impress upon you the expediency of *light loading* in your routine collecting. Three-fourths of your shots need not bring into action the gun's full powers of execution. You will shoot more birds under than over 30 yards; not

a few you must secure, if at all, at 10 or 15 yards; and your object is always to kill them with the least possible damage to the plumage. I have, on particular occasions, loaded even down to ½oz. of shot and 1½dr. of powder. There is astonishing force compressed in a few grains of powder; an astonishing number of pellets in the smallest load of mustard-seed. If you *can* load so nicely as to just drive the shot into a bird and not through it and out again, do so, and save half the holes in the skin.

To Shoot successfully is an art which may be acquired by practice, and can be learned only in the school of experience. No general directions will make you a good shot, any more than a proficient in music or painting. To tell you that in order to hit a bird you must point the gun at it and press the trigger, is like saying that to play on the fiddle you must shove the bow across the strings with one hand while you finger them with the other; in either case the result is the same, a noise — *vox et præterea nihil* — but neither music nor game. Nor is it possible for every one to become an artist in gunnery; a "crack shot," like a poet, is born, not made. For myself I make no pretensions to genius in that direction; for although I generally make fair bags, and have destroyed many thousand birds in my time, this is rather owing to some familiarity I have gained with the habits of birds, and a certain knack, acquired by long practice, of picking them out of trees and bushes, than to skilful shooting from the sportsman's standpoint; in fact, if I cut down two or three birds on the wing without a miss I am working quite up to my average in that line. But any one not a purblind "butter fingers," can become a reasonably fair shot by practice, and do good collecting. It is not so hard, after all, to sight a gun correctly on an immovable object, and collecting differs from sporting proper in this, that comparatively few birds are shot on the wing. But I do not mean to imply that it requires less skill to collect successfully than to secure game; on the contrary, it is finer shooting, I think, to drop a warbler skipping about a tree-top than to stop a quail at full speed; while hitting a sparrow that springs from the grass at one's feet to flicker in sight a few seconds and disappear is the most difficult of all shooting. Besides, a crack shot, as understood, aims unconsciously, with mechanical accuracy and certitude of hitting; he simply wills, and the trained muscles obey without his superintendence, just as the fingers form letters with the pen in writing; whereas the collector must usually supervise his muscles all through the act and see that they mind. In spite of the proportion of snap shots of all sorts you will have to take, your collecting shots, as a rule, are made with deliberate aim. There is much the same difference, on the whole, between the sportsman's work and the collector's, that there is between shot-gun and rifle practice, collecting being comparable to the latter. It is generally understood that the acme of skill with the two weapons is an incompatibility; and, certainly, the best shot is not always the best collector, even supposing the two to be on a par in their knowledge of birds' haunts and habits. Still a hopelessly poor shot can only attain fair results by extraordinary diligence and perseverance. Certain principles of shooting may perhaps be reduced to words. Aim deliberately directly at an immovable object at fair range. Hold over a motionless object when far off, as the trajectory of the shot curves downward. Hold a little to one side of a stationary object when very near, preferring rather to take the chances of missing it with the peripheral pellets, than of hopelessly mutilating it with the main body of the charge. Fire at the first fair aim, without trying to improve what is good enough already. Never "pull" the trigger, but *press* it. Bear the shock of discharge without flinching. In shooting on the wing, fire the instant the but of the gun taps your shoulder; you will miss at first, but by and by the birds will begin to drop, and you will have laid the foundation of good shooting, the knack of "covering" a bird unconsciously. The habit of "poking" after a bird on the wing is an almost incurable vice, and may keep you a poor shot all your life. (The collector's frequent necessity of poking after little birds in the bush is just what so often hinders him from acquiring brilliant execution.) Aim *ahead* of a

flying bird — the calculation to be made varies, according to the distance of the object, its velocity, its course and the wind, from a few inches to several feet; practice will finally render it intuitive.

§ 2. — DOGS.

A Good Dog is one of the most faithful, respectful, affectionate and sensible of brutes; deference to such rare qualities demands a chapter, however brief. A trained dog is the indispensable servant of the sportsman in his pursuit of most kinds of game; but I trust I am guilty of no discourtesy to the noble animal, when I say that he is a luxury rather than a necessity to the collector — a pleasant companion, who knows almost everything except how to talk, who converses with his eyes and ears and tail, shares comforts and discomforts with equal alacrity, and occasionally makes himself useful. So far as a collector's work tallies with that of a sportsman, the dog is equally useful to both; but finding and telling of *game* aside, your dog's services are restricted to companionship and retrieving. He may, indeed, flush many sorts of birds for you; but he does it, if at all, at random, while capering about; for the brute intellect is limited after all, and cannot comprehend a naturalist. The best trained setter or pointer that ever marked a quail could not be made to understand what you are about, and it would ruin him for sporting purposes if he did. Take a well-bred dog out with you, and the chances are he will soon trot home in disgust at your performances with jack-sparrows and tomtits. It implies such a lowering and perversion of a good dog's instincts to make him really a useful servant of yours, that I am half inclined to say nothing about retrieving, and tell you to make a companion of your dog, or let him alone. I was followed for several years by "the best dog I ever saw" (every one's gun, dog, and child is the best ever seen), and a first-rate retriever; yet I always preferred, when practicable, to pick up my own birds, rather than let a delicate plumage into a dog's mouth, and scolded away the poor brute so often, that she very properly returned the compliment, in the end, by retrieving just when she felt like it. However, we remained the best of friends. Any good setter, pointer, or spaniel, and some kinds of curs, may be trained to retrieve. The great point is to teach them not to "mouth" a bird; it may be accomplished by sticking pins in the ball with which their early lessons are taught. Such dogs are particularly useful in bringing birds out of the water, and in searching for them when lost. One point in training should never be neglected: teach a dog what "to heel" means, and make him obey this command. A riotous brute is simply unendurable under any circumstances.

§ 3. — VARIOUS SUGGESTIONS AND DIRECTIONS FOR FIELD-WORK.

To be a Good Collector, and nothing more, is a small affair; great skill may be acquired in the art, without a single quality commanding respect. One of the most vulgar, brutal, and ignorant men I ever knew was a sharp collector and an excellent taxidermist. Collecting stands much in the same relation to ornithology that the useful and indispensable office of an apothecary bears to the duties of a physician. A field-naturalist is always more or less of a collector; the latter is sometimes found to know almost nothing of natural history worth knowing. The true ornithologist goes out to study birds alive and destroys some of them simply because that is the only way of learning their structure and technical characters. There is much more about a bird than can be discovered in its dead body, — how much more, then, than can be found out from its stuffed skin! In my humble opinion the man who only gathers birds, as a miser money, to swell his cabinet, and that other man who gloats, as miser-like, over the same hoard, both work on a plane far beneath where the enlightened naturalist stands. One looks at Nature, and never knows that she is beautiful; the other knows she is beautiful, as even a corpse may be; the naturalist catches her sentient expression, and knows

how beautiful she is! I would have you to know and love her; for fairer mistress never swayed the heart of man. Aim high! — press on, and leave the half-way house of mere collectorship far behind in your pursuit of a delightful study, nor fancy the closet its goal.

Birds may be sought anywhere, at any time; they should be sought everywhere, at all times. Some come about your doorstep to tell their stories unasked. Others spring up before you as you stroll in the field, like the flowers that enticed the feet of Proserpine. Birds flit by as you measure the tired roadside, lending a tithe of their life to quicken your dusty steps. They disport overhead at hide-and-seek with the foliage as you loiter in the shade of the forest, and their music now answers the sigh of the tree-tops, now ripples an echo to the voice of the brook. But you will not always so pluck a thornless rose. Birds hedge themselves about with a bristling girdle of brier and bramble you cannot break; they build their tiny castles in the air surrounded by impassable moats, and the drawbridges are never down. They crown the mountain-top you may lose your breath to climb; they sprinkle the desert where your parched lips may find no cooling draught; they fleck the snow-wreath when the nipping blast may make you turn your back; they breathe unharmed the pestilent vapors of the swamp that mean disease, if not death, for you; they outride the storm at sea that sends strong men to their last account. Where now will you look for birds?

And yet, as skilled labor is always most productive, so expert search yields more than random or blundering pursuit. *Imprimis;* The more varied the face of a country, the more varied its birds. A place all plain, all marsh, all woodland, yields its particular set of birds, perhaps in profusion: but the kinds will be limited in number. It is of first importance to remember this, when you are so fortunate as to have choice of a collecting-ground; and it will guide your steps aright in a day's walk anywhere, for it will make you leave covert for open, wet for dry, high for low and back again. Well-watered country is more fruitful of bird-life than desert or even prairie; warm regions are more productive thon cold ones. As a rule, variety and abundance of birds are in direct ratio to diversity and luxuriance of vegetation. Your most valuable as well as largest bags may be made in the regions most favored botanically, up to the point where exuberance of plant-growth mechanically opposes your operations.

Search for particular Birds can only be well directed, of course, by a knowledge of their special haunts and habits, and is one of the mysteries of wood-craft only solved by long experience and close observation. Here is where the true naturalist bears himself with conscious pride and strength, winning laurels that become him, and do honor to his calling. Where to find *game* ("game" is anything that vulgar people do not ridicule you for shooting) of all the kinds we have in this country has been so often and so minutely detailed in sporting-works that it need not be here enlarged upon, especially since, being the best known, it is the least valuable of ornithological material. Most *large* or otherwise conspicuous birds have very special haunts that may be soon learned; and as a rule such rank next after game in ornithological disesteem. Birds of prey are an exception to these statements; they range everywhere, and most of them are worth securing. Hawks will unwittingly fly in your way oftener than they will allow you to approach them when perched: be ready for them. Owls will be startled out of their retreats in thick bushes, dense foliage, and hollow trees, in the daytime; if hunting them at night, good aim in the dark may be taken by rubbing a wet lucifer match on the sight of the gun, causing a momentary glimmer. Large and small waders are to be found by any water's edge, in open marshes, and often on dry plains; the herons more particularly in heavy bogs and dense swamps. Under cover, waders are oftenest approached by stealth; in the open, by strategy; but most of the smaller kinds require the exercise of no special precautions. Swimming birds, aside from water-fowl (as the "game" kinds are called), are generally shot from a boat, as they fly past; but at their breeding places many kinds that congre-

gate in vast numbers are more readily reached. There is a knack of shooting loons and grebes on the water; if they are to be reached at all by the shot it will be by aiming not directly at them but at the water just in front of them. They do not go under just where they float, but kick up behind like a jumping-jack and plunge *forward*. Rails and several kinds of sparrows are confined to reedy marshes. But why prolong such desultory remarks? Little can be said to the point without at least a miniature treatise on ornithology; and I have not yet even alluded to the diversified host of small insectivorous and granivorous birds that fill our woods and fields. The very existence of most of these is unknown to all but the initiated; yet they include the treasures of the ornithologist. Some are plain and humble, others are among the most beautiful objects in nature; but most agree in being *small*, and therefore liable to be overlooked. The sum of my advice about them must be brief. Get over as much ground, both wooded and open, as you can thoroughly examine in a day's tramp, and go out as many days as you can. It is not always necessary, however, to keep on the tramp, especially during the migration of the restless insectivorous species. One may often shoot for hours without moving more than a few yards, by selecting a favorable locality and allowing the birds to come to him as they pass in varied troops through the low woodlands or swampy thickets. Keep your eyes and ears wide open. Look out for every rustling leaf and swaying twig and bending blade of grass. Hearken to every note, however faint; when there is no sound, listen for a chirp. Habitually move as noiselessly as possible. Keep your gun *always* ready. Improve every opportunity of studying a bird you do not wish to destroy; you may often make observations more valuable than the specimen. Let this be the rule with all birds you recognize. But I fear I must tell you to shoot an unknown bird on sight; it may give you the slip in a moment and a prize may be lost. One of the most fascinating things about field-work is its delightful uncertainty: you never know what's in store for you as you start out; you never can tell what will happen next; surprises are always in order, and excitement is continually whetted on the chances of the varied chase.

For myself, the time is past, happily or not, when every bird was an agreeable surprise, for dewdrops do not last all day; but I have never yet walked in the woods without learning something pleasant that I did not know before. I should consider a bird new to science ample reward for a month's steady work; *one* bird new to a locality would repay a week's search; a day is happily spent that shows me any bird that I never saw alive before. How then can you, with so much before you, keep out of the woods another minute?

All Times are good times to go a-shooting; but some are better than others. (*a.*) *Time of year.* In all temperate latitudes, spring and fall — periods of migration with most birds — are the most profitable seasons for collecting. Not only are birds then most numerous, both as species and as individuals, and most active, so as to be the more readily found, but they include a far larger proportion of rare and valuable kinds. In every locality in this country the periodical visitants outnumber the permanent residents; in most regions the number of regular migrants, that simply pass through in the spring and fall, equals or exceeds that of either of the sets of species that come from the south in spring to breed during the summer, or from the north to spend the winter. Far north, of course, on or near the limit of the vernal migration, where there are few if any migrants *passing through*, and where the winter birds are extremely few, nearly all the bird fauna is composed of "summer visitants;" far south, in this country, the reverse is somewhat the case, though with many qualifications. Between these extremes, what is conventionally known as "a season" means the period of the vernal or autumnal migration. For example, the body of birds present in the District of Columbia (where I collected for several years) in the two months from April 20th to May 20th, and from September 10th to October 10th, is undoubtedly greater, as far as individuals are concerned, than the total number found there at all other seasons of the year together. As for species, the number

of migrants about equals that of summer visitants; the permanent residents equal the winter residents, both these being fewer than either of the first mentioned sets; while the irregular visitors, or stragglers, that complete the bird fauna, are about, or rather less than one-half as many as the species of either of the other categories. About Washington, therefore, I would readily undertake to secure a greater *variety* of birds in the nine weeks above specified than in all the rest of the year; for in that time would be found, not only all the permanent residents, but nearly all the migrants, and almost all the summer visitants; while the number of individual birds that might be taken exceeds, by quite as much, the number of those procurable in the same length of time at any other season. *Mutatis mutandis*, it is the same everywhere in this country. Look out then, for "the season;" work all through it at a rate you could not possibly sustain the year around; and make hay while the sun shines. (*b.*) *Time of day.* Early in the morning and late in the afternoon are the best times for birds. There is a mysterious something in these diurnal crises that sets bird-life astir, over and above what is explainable by the simple fact that they are the transition periods from repose to activity, or the reverse. Subtile meteorological changes occur; various delicate instruments used in physicists' researches are sometimes inexplicably disturbed; diseases have often their turning point for better or worse; people are apt to be born or die; and the susceptible organisms of birds manifest various excitements. Whatever the operative influence, the fact is, birds are particularly lively at such hours. In the dark, they rest — most of them do; at noonday, again, they are comparatively still; between these times they are passing to or from their feeding grounds or roosting places; they are foraging for food, they are singing; at any rate, they are in motion. Many migratory birds (among them warblers, etc.) perform their journeys by night; just at daybreak they may be seen to descend from the upper regions, rest a while, and then move about briskly, singing and searching for food. Their meal taken, they recuperate by resting till towards evening; feed again and are off for the night. If you have had some experience, don't you remember what a fine spurt you made early that morning? — how many unexpected shots offered as you trudged home belated that evening? Now I am no fowl, and have no desire to adopt the habits of the hen-yard; I have my opinion of those who like the world before it is aired; I think it served the worm right for getting up, when caught by the early bird; nevertheless I go shooting betimes in the morning, and would walk all night to find a rare bird at daylight. (*c.*) *Weather.* It rarely occurs in this country that either heat or cold is unendurably severe; but extremes of temperature are unfavorable, for two reasons: they both occasion great personal discomfort; and in one extreme only a few hardy birds will be found, while in the other most birds are languid, disposed to seek shelter, and therefore less likely to be found. A still, cloudy day of moderate temperature offers as a rule the best chance; among other reasons, there is no sun to blind the eyes, as always occurs on a bright day in one direction, particularly when the sun is low. While a bright day has its good influence in setting many birds astir, some others are most easily approached in heavy or falling weather. Some kinds are more likely to be secured during a light snowfall, or after a storm. Singular as it may seem, a thoroughly wet day offers some peculiar inducements to the collector. I cannot well specify them, but I heartily indorse a remark John Cassin once made to me: — "I like," said he, "to go shooting in the rain sometimes; there are some curious things to be learned about birds when the trees are dripping, things too that have not yet found their way into the books."

How many Birds of the Same Kind do you want? — *All you can get* — with some reasonable limitations; say fifty or a hundred of any but the most abundant and widely diffused species. You may often be provoked with your friend for speaking of some bird he shot, but did not bring you, because, he says, "Why, you've got one like that!" Birdskins are capital; capital unemployed may be useless, but can never be worthless. Birdskins are a

medium of exchange among ornithologists the world over; they represent value, — money value and scientific value. If you have more of one kind than you can use, exchange with some one for species you lack; both parties to the transaction are equally benefited. Let me bring this matter under several heads. (*a.*) Your own "series" of skins of any species is incomplete until it contains at least one example of each sex, of every normal state of plumage, and every normal transition stage of plumage, and further illustrates at least the principal abnormal variations in size, form, and color to which the species may be subject; I will even add that every different faunal area the bird is known to inhabit should be represented by a specimen, particularly if there be anything exceptional in the geographical distribution of the species. Any additional specimens to all such are your *only* "duplicates," properly speaking. (*b.*) Birds vary so much in their size, form, and coloring, that a "specific character" can only be precisely determined from examination of a large number of specimens, shot at different times, in different places; still less can the "limits of variation" in these respects be settled without ample materials. (*c.*) The *rarity* of any bird is necessarily an arbitrary and fluctuating consideration, because in the nature of the case there can be no natural unit of comparison, nor standard of appreciation. It may be said, in general terms, no bird is actually "rare." With a few possible exceptions, as in the cases of birds occupying extraordinarily limited areas, like some of the birds of paradise, or about to become extinct, like the pied duck, enough birds of all kinds exist to overstock every public and private collection in the world, without sensible diminution of their numbers. "Rarity" or the reverse is only predicable upon the accidental (so to speak) circumstances that throw, or tend to throw, specimens into naturalists' hands. *Accessibility* is the variable element in every case. The fulmar petrel is said (on what authority I know not) to exceed any other bird in its aggregate of individuals; how do the skins of that bird you have handled compare in number with specimens you have seen of the "rare" warbler of your own vicinity? All birds are common somewhere at some season; the point is, have collectors been there at the time? Moreover, even the arbitrary appreciation of "rarity" is fluctuating, and may change at any time; long sought and highly prized birds are liable to appear suddenly in great numbers in places that knew them not before; a single heavy "invoice" of a bird from some distant or little-explored region may at once stock the market, and depreciate the current value of the species to almost nothing. For example, Baird's bunting and Sprague's lark remained for thirty years among our special desiderata, only one specimen of the former and two or three of the latter being known. Yet they are two of the most abundant birds of Dakota, where in 1873 I took as many of both as I desired; and specimens enough have lately been secured to stock all the leading museums of this country and Europe. (*d.*) Some practical deductions are to be made from these premises. Your object is to make yourself acquainted with all the birds of your vicinity, and to preserve a complete suite of specimens of every species. Begin by shooting every bird you can, coupling this sad destruction, however, with the closest observations upon habits. You will very soon fill your series of a few kinds, that you find almost everywhere, almost daily. Then if you are in a region the ornithology of which is well known to the profession, at once stop killing these common birds — they are in every collection. You should not, as a rule, destroy any more robins, bluebirds, song-sparrows, and the like, than you want for yourself. Keep an eye on them, studying them always, but turn your actual pursuit into other channels, until in this way, gradually eliminating the undesirables, you exhaust the bird fauna as far as possible (you will not *quite* exhaust it — at least for many years). But if you are in a new or little-known locality, I had almost said the very reverse course is the best. The chances are that the most abundant and characteristic birds are "rare" in collections. Many a bird's range is quite restricted: you may happen to be just at its metropolis; seize the opportunity, and get good store, — yes, up to fifty or a hundred; all you can spare will be thankfully received by those who have none. Quite as likely, birds that are scarce just where you happen

to be, are so only because you are on the edge of their habitat, and are plentiful in more accessible regions. But, rare or not, it is always a point to determine the exact geographical distribution of a species; and this is fixed best by having specimens to tell each its own tale, from as many different and widely separated localities as possible. This alone warrants procuring one or more specimens in every locality; the commonest bird acquires a certain value if it be captured away from its ordinary range. An Eastern bluebird (*Sialia sialis*) shot in California might be considered more valuable than the "rarest" bird of that State, and would certainly be worth a hundred Massachusetts skins; a varied thrush (*Turdus nævius*) killed in Massachusetts is worth a like number from Oregon. But let all your justifiable destruction of birds be tempered with mercy; your humanity will be continually shocked with the havoc you work, and should never permit you to take life wantonly. Never shoot a bird you do not fully intend to preserve, or to utilize in some proper way. Bird-life is too beautiful a thing to destroy to no purpose; too sacred a thing, like all life, to be sacrificed, unless the tribute is hallowed by worthiness of motive. "Not a sparrow falleth to the ground without His notice."

I should not neglect to speak particularly of the care to be taken to secure full suites of *females*. Most miscellaneous collections contain four or more males to every female, — a disproportion that should be as far reduced as possible. The occasion of the disparity is obvious: females are usually more shy and retiring in disposition, and consequently less frequently noticed, while their smaller size and plainer plumage, as a rule, further favor their eluding observation. The difference in coloring is greatest among those groups where the males are most richly clad, and the shyness of the mother birds is most marked during the breeding season, just when the males, full of song, and in their nuptial attire, become most conspicuous. It is often worth while to neglect the gay Benedicts, to trace out and secure the plainer but not less interesting females. This pursuit, moreover, often leads to discovery of the nests and eggs, — an important consideration. Although both sexes are generally found together when breeding, and mixing indiscriminately at other seasons, they often go in separate flocks, and often migrate independently of each other; in this case the males usually in advance. Towards the end of the passage of some warblers, for instance, we may get almost nothing but females, all our specimens of a few days before having been males. The notable exceptions to the rule of smaller size of the female are among rapacious birds and many waders, though in these last the disparity is not so marked. I only recall one instance, among American birds, of the female being more richly colored than the male — the phalaropes. When the sexes are notably different in adult life, the *young* of both sexes usually resemble the adult female, the young males gradually assuming their distinctive characters. When the adults of both sexes are alike, the young commonly differ from them.

In the same connection I wish to urge a point, the importance of which is often overlooked; it is our practical interpretation of the adage, "a bird in the hand is worth two in the bush." Always keep the first specimen you secure of a species till you get another; no matter how common the species, how poor the specimen, or how certain you may feel of getting other better ones, *keep it*. Your most reasonable calculations may come to naught, from a variety of circumstances, and *any* specimen is better than no specimen, on general principles. And in general, do not, if you can help it, discard any specimen *in the field*. No tyro can tell what will prove valuable and what not; while even the expert may regret to find that a point comes up which a specimen he injudiciously discarded might have determined. Let a collection be "weeded out," if at all, only after deliberate and mature examination, when the scientific results it affords have been elaborated by a competent ornithologist; and even then, the refuse (with certain limitations) had better be put where it will do *some* good, than be destroyed utterly. For instance, I myself once valued, and used, some Smithsonian "sweepings"; and I know very well what to do with specimens, *now*, to which I would not give house-room in my own cabinet. If forced to reduce bulk, owing to limited facilities for transportation in the field

(as too often happens), throw away according to *size*, other things being equal. Given only so many cubic inches or feet, eliminate the few *large* birds which take up the space that would contain fifty or a hundred different little ones. If you have a fine large bald eagle or pelican, for instance, throw it away first, and follow it with your ducks, geese, etc. In this way, the bulk of a large miscellaneous collection may be reduced one half, perhaps, with very little depreciation of its actual value. The same principle may be extended to other collections in natural history (excepting fossils, which are always weighty, if not also bulky); very few bird-skins, indeed, being as valuable contributions to science as, for example, a vial of miscellaneous insects that occupies no more room may prove to be.

What is "A Good Day's Work?" — Fifty birds shot, their skins preserved, and observations recorded, is a *very* good day's work; it is sharp practice, even when birds are plentiful. I never knew a person to *average* anywhere near it; even during the "season" such work cannot possibly be sustained. You may, of course, by a murderous discharge into a flock, as of blackbirds or reedbirds, get a hundred or more in a moment; but I refer to collecting a fair variety of birds. You will do very well if you *average* a dozen a day during the seasons. I doubt whether any collector ever averaged as many the year around; it would be over four thousand specimens annually. The greatest number I ever procured *and prepared* in one day was forty, and I have not often gone over twenty. Even when collecting regularly and assiduously, I am satisfied to average a dozen a day during the migrations, and one-third or one-fourth as many the rest of the year. Probably this implies the shooting of about one in five not skinned for various reasons, as mutilation, decay, or want of time.

Approaching Birds.— There is little if any trouble in getting near enough to shoot most birds. With notable exceptions, they are harder to see when near enough, or to hit when seen; particularly small birds that are almost incessantly in motion. As a rule — and a curious one it is — difficulty of approach is in direct ratio to the *size* of the bird; it is perhaps because large conspicuous birds are objects of more general pursuit than the little ones you ordinarily search for. The qualities that birds possess for self-preservation may be called *wariness* in large birds, *shyness* in small ones. The former make off knowingly from a suspicious object; the latter fly from anything that is strange to them, be it dangerous or not. This is strikingly illustrated in the behavior of small birds in the wilderness, as contrasted with their actions about towns; singular as it may seem, they are more timid under the former circumstances than when grown accustomed to the presence of man. It is just the reverse with a hawk or raven, for instance; in populous districts they spend much of their time in trying to save their skins, while in a new country they have not learned, like Indians, that a white man is "mighty uncertain." In stealing on a shy bird, you will of course take advantage of any cover that may offer, as inequalities of the ground, thick bushes, the trunks of trees; and it is often worth while to make a considerable détour to secure unobserved approach. I think that birds are more likely, as a rule, to be frightened away by the movements of the collector, than by his simple presence, however near, and that they are more afraid of noise than of mere motion. Crackling of twigs and rustling of leaves are sharp sounds, though not loud ones; you may have sometimes been surprised to find how distinctly you could hear the movements of a horse or cow in underbrush at some distance. Birds have sharp ears for such sounds. Form a habit of stealthy movement; *it tells*, in the long run, in comparison with lumbering tread. There are no special precautions to be taken in shooting through high open forest; you have only to saunter along with your eyes in the tree-tops. It is ordinarily the easiest and on the whole the most remunerative path of the collector. In traversing fields and meadows move briskly, your principal object being to flush birds out of the grass; and as most of your shots will be snap ones, keep in readiness for instant action. Excellent and varied

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shooting is to be had along the hedge rows, and in the rank herbage that fringes fences. It is best to keep at a little distance, yet near enough to arouse all the birds as you pass: you may catch them on wing, or pick them off just as they settle after a short flight. In this shooting, two persons, one on each side, can together do more than twice as much work as one. Thickets and tangled undergrowth are favorite resorts of many birds; but when very close, or, as often happens, over miry ground, they are hard places to shoot in. As you come thrashing through the brush, the little inhabitants are scared into deeper recesses; but if you keep still a few minutes in some favorable spot, they are reassured, and will often come back to take a peep at you. A good deal of standing still will repay you at such times; needless to add, you cannot be too lightly loaded for such shooting, when birds are mostly out of sight if a dozen yards off. When yourself concealed in a thicket, and no birds appear, you can often call numbers about you by a simple artifice. Apply the back of your hand to your slightly parted lips, and suck in air; it makes a nondescript "screeping" noise, variable in intonation at your whim, and some of the sounds resemble the cries of a wounded bird, or a young one in distress. It wakes up the whole neighborhood, and sometimes puts certain birds almost beside themselves, particularly in the breeding season. Torturing a wounded bird to make it scream in agony accomplishes the same result, but of course is only permissible under great exigency. In penetrating swamps and marshes, the best advice I can give you is to tell you to get along the best way you can. Shooting on perfectly open ground offers much the same case; you must be left to your own devices. I will say, however, you can ride on horseback, or even in a buggy, nearer birds than they will allow you to walk up to them. Sportsmen take advantage of this to get within a shot of the upland plover, usually a very wary bird in populous districts; I have driven right into a flock of wild geese; in California they often train a bullock to graze gradually up to geese, the gunner being hidden by its body. There is one trick worth knowing; it is not to let a bird that has seen you know by your action that you have seen *it*, but to keep on unconcernedly, gradually sidling nearer. I have secured many hawks in this way, when the bird would have flown off at the first step of direct approach. Numberless other little arts will come to you as your wood-craft matures.

Recovering Birds. — It is not always that you secure the birds you kill; you may not be able to find them, or you may see them lying, perhaps but a few feet off, in a spot practically inaccessible. Under such circumstances a retriever does excellent service, as already hinted; he is equally useful when a bird properly "marked down" is not found there, having fluttered or run away and hidden elsewhere. The most difficult of all places to find birds is among reeds, the eternal sameness of which makes it almost impossible to rediscover a spot whence the eye has once wandered, while the peculiar growth allows birds to slip far down out of sight. In rank grass or weeds, when you have walked up with your eye fixed on the spot where the bird seemed to fall, yet failed to discover it, drop your cap or handkerchief for a mark, and hunt around it as a centre, in enlarging circles. In thickets, make a "bee line" for the spot, if possible keeping your eye on the spray from which the bird fell, and not forgetting where you stood on firing; you may require to come back to the spot and take a new departure. You will not seldom see a bird just shot at fly off as if unharmed, when really it will drop dead in a few moments. In all cases therefore when the bird does not drop at the shot, follow it with your eyes as far as you can; if you see it finally drop, or even flutter languidly downward, mark it on the principles just mentioned, and go in search. Make every endeavor to secure wounded birds, on the score of humanity; they should not be left to pine away and die in lingering misery if it can possibly be avoided.

Killing Wounded Birds. — You will often recover winged birds, as full of life as before the bone was broken; and others too grievously hurt to fly, yet far from death. Your object is

to kill them as quickly and as painlessly as possible, without injuring the plumage. This is to be accomplished, with all small birds, by suffocation. The respiration and circulation of birds is very active, and most of them die in a few moments if the lungs are so compressed that they cannot breathe. Squeeze the bird tightly across the chest, under the wings, thumb on one side, middle finger on the other, forefinger pressed in the hollow at the root of the neck, between the forks of the merrythought. Press firmly, hard enough to fix the chest immovably and compress the lungs, but not to break in the ribs. The bird will make vigorous but ineffectual efforts to breathe, when the muscles will contract spasmodically; but in a moment more, the system relaxes with a painful shiver, light fades from the eyes, and the lids close. I assure you, it will make you wince the first few times; you had better habitually hold the poor creature behind you. You can tell by its limp feel and motionlessness when it is dead, without watching the sad struggle. Large birds obviously cannot be dealt with in this way; I would as soon attempt to throttle a dog as a loon, for instance, upon which all the pressure you can give makes no sensible impression. A winged hawk, again, will throw itself on its back as you come up, and show such good fight with beak and talons, that you may be quite severely scratched in the encounter: meanwhile the struggling bird may be bespattering its plumage with blood. In such a case — in any case of a large bird making decided resistance — I think it best to step back a few paces and settle the matter with a light charge of mustard-seed. Any large bird once secured may be speedily dispatched by stabbing to the heart with some slender instrument thrust in under the wing — care must be taken too about the bleeding; or, it may be instantly killed by piercing the brain with a knife introduced into the mouth and driven upward and obliquely backward from the palate. The latter method is preferable as it leaves no outward sign and causes no bleeding to speak of. With your thumb, you may indent the back part of a bird's skull so as to compress the cerebellum; if you can get deep enough in, without materially disordering the plumage, or breaking the skin, the method is unobjectionable.

Handling Bleeding Birds. — Bleeding depends altogether upon the part or organ wounded; but other things being equal, violence of the hæmorrhage is usually in direct proportion to the size of the shot-hole; when mustard-seed is used it is ordinarily very trifling, if it occur at all. Blood flows oftener from the orifice of *exit* of a shot, than from the wound of entrance, for the latter is usually plugged with a little wad of feathers driven in. Bleeding from the mouth or nostrils is the rule when the lungs are wounded. When it occcurs, hold up the bird by the feet, and let it drip; a general squeeze of the body in that position will facilitate the drainage. In general, hold a bird so that a bleeding place is most dependent; then, pressure about the part will help the flow. A "gob" of blood, which is simply a forming clot, on the plumage may often be dexterously flipped almost clean away with a snap of the finger. It is first-rate practice to take cotton and forceps into the field to plug up shot-holes, and stop the mouth and nostrils and vent on the spot. I follow the custom of the books in recommending this, but I will confess I have rarely done it myself, and I suspect that only a few of our most leisurely and elegant collectors do so habitually. Shot-holes may be found by gently raising the feathers, or blowing them aside; you can of course get only a tiny plug into the wound itself, but it should be one end of a sizable pledget, the rest lying fluffy among the feathers. In stopping the mouth or vent, ram the fluff of cotton, entirely inside. You cannot conveniently stop up the nostrils of small birds separately; but take a light cylinder of cotton, lay it transversely across the base of the upper mandible, closely covering the nostrils, and confine it there by tucking each end tightly into the corner of the mouth. In default of such nice fixing as this, a pinch of dry loam pressed on a bleeding spot will plaster itself there and stop further mischief. Never try to *wipe off* fresh blood that has already wetted the plumage; you will only make matters worse. Let it dry on, and then — but the treatment of blood-stains, and other soilings of plumage, is given beyond.

Carrying Birds Home Safe. — Suppose you have secured a fine specimen, very likely without a soiled or ruffled feather; your next care will be to keep it so till you are ready to skin it. But if you pocket or bag it directly, it will be a sorry-looking object before you get home. Each specimen must be separately cared for, by wrapping in stout paper; writing paper is as good as any, if not the best. It will repay you to prepare a stock of paper before starting out; your most convenient sizes are those of a half-sheet of note, of letter, and of cap respectively. Either take these, or fold and cut newspaper to correspond; besides, it is always well to have a *whole* newspaper or two for large birds. Plenty of paper will go in the breast pockets of the shooting-coat. Make a "cornucopia," — the simplest thing in the world, but, like tying a particular knot, hard to explain. Setting the wings closely, adjusting disturbed feathers, and seeing that the bill points straight forward, thrust the bird head first into one of these paper cones, till it will go no further, being bound by the bulge of the breast. Let the cone be large enough for the open end to fold over or pinch together entirely beyond the tail. Be particular not to crumple or bend the tail-feathers. Lay the paper cases in the game bag or great pocket so that they very nearly run parallel and lie horizontal; they will carry better than if thrown in at random. Avoid overcrowding the packages, as far as is reasonably practicable; moderate pressure will do no harm, as a rule, but if great it may make birds bleed afresh, or cause the fluids of a wounded intestine to ooze out and soak the plumage of the belly, — a very bad accident indeed. For similar obvious reasons, do not put a large heavy bird on top of a lot of little ones; I would sooner sling a hawk or heron over my shoulder, or carry it by hand. If it goes in the bag, see that it gets to the bottom. Avoid putting birds in pockets that are close about your person; they are almost always unduly pressed, and may gain just enough additional warmth from your body to make them begin to decompose before you can get at skinning them. Handle birds no more than is necessary, especially white-plumaged ones; ten to one your hands are powder-begrimed: and besides, even the warmth and moisture of your palms may tend to injure a delicate feathering. Ordinarily pick up a bird by the feet or bill; as you need both hands to make the cornucopia, let the specimen dangle by the toes from your teeth while you are so employed. In catching at a wounded bird, aim to cover it entirely with your hand; but whatever you do, never seize it by the tail, which then will often be left in your hands for your pains. Never grasp wing-tips or tail-feathers; these large flat quills would get a peculiar crimping all along the webs, very difficult to efface. Finally, I would add there is a certain knack or art in manipulating, either of a dead bird or a birdskin, by which you may handle it with seeming carelessness and perfect impunity; whilst the most gingerly fingering of an inexperienced person will leave its rude trace. You will naturally acquire the correct touch; but it can be neither taught nor described.

A Special Case. — While the ordinary run of land birds will be brought home in good order by the foregoing method, some require special precautions. I refer to sea birds, such as gulls, terns, petrels, etc., shot from a boat. In the first place, the plumage of most of them is, in part at least, white and of exquisite purity. Then, fish-eating birds usually vomit and purge when shot. They are necessarily fished all dripping from the water. They are too large for pocketing. If you put them on the thwarts or elsewhere about the boat, they usually fall off, or are knocked off, into the bilge water; if you stow them in the cubby-hole, they will assuredly soil by mutual pressure, or by rolling about. It will repay you to pick them from the water by the bill, and shake off all the water you can; hold them up, or let some one do it, till they are tolerably dry; plug the mouth, nostrils, and vent, if not also shot-holes; wrap each one separately in a *cloth* (*not* paper) or a mass of tow, and pack steadily in a covered box or basket taken on board for this purpose. With such precautions as these birds most liable to be soiled reach the skinning table in perfect order; and your care will afterward transform them into specimens without spot or blemish.

§ 4. — HYGIENE OF COLLECTORSHIP.

It is Unnecessary to speak of the Healthfulness of a pursuit that, like the collector's occupation, demands regular bodily exercise, and at the same time stimulates the mind by supplying an object, thus calling the whole system into exhilarating action. Yet collecting has its perils, not to be overlooked if we would adequately guard against them, as fortunately we may, in most cases, by simple precautions. The dangers of taxidermy itself are elsewhere noticed; but, besides these, the collector is exposed to vicissitudes of the weather, may endure great fatigue, may breathe miasm, and may be mechanically injured.

Accidents from the Gun have been already treated; a few special rules will render others little liable to occur. The secret of safe *climbing* is never to relax one hold until another is secured; it is in spirit equally applicable to scrambling over rocks, a particularly difficult thing to do safely with a loaded gun. Test rotten, slippery, or otherwise suspicious holds before trusting them. In lifting the body up anywhere, keep the mouth shut, breathe through the nostrils, and go slowly. In *swimming*, waste no strength unnecessarily in trying to stem a current; yield partly, and land obliquely lower down; if exhausted, float; the slightest motion of the hands will ordinarily keep the face above water; and in any event keep your wits collected. In fording deeply, a heavy stone will strengthen your position. Never sail a boat experimentally; if you are no sailor, take one with you or stay on land. In crossing a high, narrow footpath, never look lower than your feet; the muscles will work true if not confused with faltering instructions from a giddy brain. On soft ground, see what, if anything, has preceded you; large hoof-marks generally mean that the way is safe; if none are found, inquire for yourself before going on. Quicksand is the most treacherous, because far more dangerous than it looks; but I have seen a mule's ears finally disappear in genuine mud. Cattle paths, however erratic, commonly prove the surest way out of a difficult place, whether of uncertain footing or dense undergrowth.

Miasm. — Unguarded exposure in malarious regions usually entails sickness, often preventable, however, by due precautions. It is worth knowing, in the first place, that miasmatic poison is most powerful between sunset and sunrise; more exactly, from the damp of the evening until night vapors are dissipated; we may be out in the daytime with comparative impunity, where to pass a night would be almost certain disease. If forced to camp out, seek the highest and dryest spot, put a good fire on the swamp side, and also, if possible, let trees intervene. Never go out on an empty stomach; just a cup of coffee and a crust may make a decided difference. Meet the earliest unfavorable symptoms with quinine; I should rather say, if unacclimated, anticipate them with this invaluable agent. Endeavor to maintain high health of all functions by the natural means of regularity and temperance in diet, exercise, and repose.

"Taking Cold." — This vague "household word" indicates one or more of a long varied train of unpleasant affections, nearly always traceable to one or the other of only two causes: *sudden change* of temperature, and *unequal distribution* of temperature. No extremes of heat or cold can alone effect this result; persons frozen to death do not "take cold" during the process. But if a part of the body be rapidly cooled, as by evaporation from a wet article of clothing, or by sitting in a draught of air, the rest of the body remaining at an ordinary temperature; or if the temperature of the whole be suddenly changed by going out into the cold, or, especially, by coming into a warm room, there is much liability of trouble. There is an old saying, —

> "When the air comes through a hole
> Say your prayers to save your soul;"

and I should think almost any one could get a "cold" with a spoonful of water on the wrist held to a key-hole. Singular as it may seem, sudden warming when cold is more dangerous than the reverse; every one has noticed how soon the handkerchief is required on entering a heated room on a cold day. Frost-bite is an extreme illustration of this. As the Irishman said on picking himself up, it was not the fall, but stopping so quickly that hurt him; it is not the lowering of the temperature to the freezing point, but its subsequent elevation, that devitalizes the tissue. This is why rubbing with snow, or bathing in cold water, is required to restore safely a frozen part; the arrested circulation must be very gradually re-established, or inflammation, perhaps mortification, ensues. General precautions against taking cold are almost self-evident, in this light. There is ordinarily little if any danger to be apprehended from wet clothes, so long as exercise is kept up; for the "glow" about compensates for the extra cooling by evaporation. Nor is a complete drenching more likely to be injurious than wetting of one part. But never sit still wet; and in changing rub the body dry. There is a general tendency, springing from fatigue, indolence, or indifference, to neglect damp feet; that is to say, to dry them by the fire; but this process is tedious and uncertain. I would say especially, off with the muddy boots and sodden socks at once; dry stockings and slippers, after a hunt, may make just the difference of your being able to go out again or never. Take care never to check perspiration; during this process, the body is in a somewhat critical condition, and sudden arrest of the function may result disastrously, even fatally. One part of the business of perspiration is to equalize bodily temperature, and it must not be interfered with. The secret of much that might be said about *bathing* when heated, lies here. A person overheated, panting it may be, with throbbing temples and a *dry* skin, is in danger partly because the natural cooling by evaporation from the skin is denied, and this condition is sometimes not far from a "sunstroke." Under these circumstances, a person of fairly good constitution may plunge into the water with impunity, even with benefit. But if the body be already cooling by sweating, rapid abstraction of heat from the surface may cause internal congestion, never unattended with danger. Drinking ice-water offers a somewhat parallel case; even on stooping to drink at the brook, when flushed with heat, it is well to bathe the face and hands first, and to taste the water before a full draught. It is a well-known excellent rule, not to bathe immediately after a full meal; because during digestion the organs concerned are comparatively engorged, and any sudden disturbance of the circulation may be disastrous. The imperative necessity of resisting drowsiness under extreme cold requires no comment. In walking under a hot sun, the head may be sensibly protected by green leaves or grass in the hat; they may be advantageously moistened, but not enough to drip about the ears. Under such circumstances the slightest giddiness, dimness of sight, or confusion of ideas, should be taken as a warning of possible sunstroke, instantly demanding rest and shelter.

Hunger and Fatigue are more closely related than they might seem to be; one is a sign that the fuel is out, and the other asks for it. Extreme fatigue, indeed, destroys appetite; this simply means, temporary incapacity for digestion. But even far short of this, food is more easily digested and better relished after a little preparation of the furnace. On coming home tired, it is much better to make a leisurely and reasonably nice toilet than to eat at once, or to lie still thinking how tired you are; after a change and a wash you will feel like a "new man," and go to table in capital state. Whatever dietetic irregularities a high state of civilization may demand or render practicable, a normally healthy person is inconvenienced almost as soon as his regular meal-time passes without food; a few can work comfortably or profitably fasting over six or eight hours. Eat before starting; if for a day's tramp, take a lunch; the most frugal meal will appease if it do not satisfy hunger, and so postpone its urgency. As a small scrap of practical wisdom, I would add, keep the remnants of the lunch, if there are any; for you cannot always be sure of getting in to supper.

Stimulation. — When cold, fatigued, depressed in mind, and on other occasions, you may feel inclined to resort to artificial stimulus. Respecting this many-sided theme I have a few words to offer of direct bearing on the collector's case. It should be clearly understood in the first place that a stimulant confers no strength whatever; it simply calls the powers that be into increased action at their own expense. Seeking real strength in stimulus is as wise as an attempt to lift yourself up by the boot-straps. You may gather yourself to leap the ditch and you clear it; but no such muscular energy can be sustained; exhaustion speedily renders further expenditure impossible. But now suppose a very powerful mental impression be made, say the circumstance of a succession of ditches in front, and a mad dog behind; if the stimulus of terror be sufficiently strong, you may leap on till you drop senseless. Alcoholic stimulus is a parallel case, and is not seldom pushed to the same extreme. Under its influence you never can tell when you *are* tired; the expenditure goes on, indeed, with unnatural rapidity, only it is not felt at the time; but the upshot is you have all the original fatigue to endure and to recover from, *plus* the fatigue resulting from over-excitation of the system. Taken as a fortification against cold, alcohol is as unsatisfactory as a remedy for fatigue. Insensibility to cold does not imply protection. The fact is the exposure is greater than before; the circulation and respiration being hurried, the waste is greater, and as sound fuel cannot be immediately supplied, the temperature of the body is soon lowered. The transient warmth and glow over, the system has both cold *and* depression to endure; there is no use in borrowing from yourself and fancying you are richer. Secondly, the value of any stimulus (except in a few exigencies of disease or injury) is in proportion, not to the intensity, but to the equableness and durability of its effect. This is one reason why tea, coffee, and articles of corresponding qualities, are preferable to alcoholic drinks; they work so smoothly that their effect is often unnoticed, and they "stay by" well; the friction of alcohol is tremendous in comparison. A glass of grog may help a veteran over the fence, but no one, young or old, can shoot all day on liquor. I have had so much experience in the use of tobacco as a mild stimulant that I am probably no impartial judge of its merits: I will simply say I do not use it in the field, because it indisposes to muscular activity, and favors reflection when observation is required; and because temporary abstinence provokes the morbid appetite and renders the weed more grateful afterwards. Thirdly, undue excitation of any physical function is followed by corresponding depression, on the simple principle that action and reaction are equal; and the balance of health turns too easily to be wilfully disturbed. Stimulation is a draft upon vital capital, when interest alone should suffice; it may be needed at times to bridge a chasm, but habitual living beyond vital income infallibly entails bankruptcy in health. The use of alcohol in health seems practically restricted to purposes of sensuous gratification on the part of those prepared to pay a round price for this luxury. The three golden rules here are, — never drink before breakfast, never drink alone, and never drink bad liquor; their observance may make even the abuse of alcohol tolerable. Serious objections for a naturalist, at least, are that science, viewed through a glass, seems distant and uncertain, while the joys of rum are immediate and unquestionable; and that intemperance, being an attempt to defy certain physical laws, is therefore eminently unscientific.

§ 5 — REGISTRATION AND LABELLING.

A mere Outline of a Field Naturalist's Duties would be inexcusably incomplete without mention of these important matters; and, because so much of the business of collecting *must* be left to be acquired in the school of experience, I am the more anxious to give explicit directions whenever, as in this instance, it is possible to do so.

Record your Observations Daily. — In one sense the specimens themselves are your record, — *prima facie* evidence of your industry and ability; and if labelled, as I shall presently

advise, they tell no small part of the whole story. But this is not enough; indeed, I am not sure that an ably conducted ornithological journal is not the better half of your operations. Under your editorship of labelling, specimens tell what they know about themselves; but you can tell much more yourself. Let us look at a day's work: You have shot and skinned so many birds and laid them away labelled. You have made observations about them before shooting, and have observed a number of birds that you did not shoot. You have items of haunts and habits, abundance or scarcity; of manners and actions under special circumstances, as of pairing, nesting, laying, rearing young, feeding, migrating, and what not; various notes of birds are still ringing in your ears; and finally, you may have noted the *absence* of species you saw a while before, or had expected to occur in your vicinity. Meteorological and topographical items, especially when travelling, are often of great assistance in explaining the occurrences and actions of birds. Now *you* know these things, but very likely no one else does; and you know them *at the time*, but you will not recollect a tithe of them in a few weeks or months, to say nothing of years. Don't trust your memory: it will trip you up; what is clear now will grow obscure; what is found will be lost. Write down everything while it is fresh in your mind; write it out in full: time so spent now will be time saved in the end, when you offer your researches to the discriminating public. Don't be satisfied with a dry-as-dust item; clothe a skeleton fact, and breathe life into it with thoughts that glow; let the paper smell of the woods. There 's a pulse in a new fact; catch the rhythm before it dies. Keep off the quicksands of mere memorandum — that means something "to be remembered," which is just what you cannot do. Shun abbreviations; such keys rust with disuse, and may fail in after times to unlock the secret that should have been laid bare in the beginning. Use no signs intelligible only to yourself: your note-books may come to be overhauled by others whom you would not wish to disappoint. Be sparing of sentiment, a delicate thing, easily degraded to drivel: crude enthusiasm always hacks instead of hewing. Beware of literary infelicities: "the written word remains," it may be, after you have passed away; put down nothing for your friend's blush, or your enemy's sneer; write as if a stranger were looking over your shoulder.

Ornithological Book-keeping may be left to your discretion and good taste in the details of execution. Each may consult his preferences for rulings, headings, and blank forms of all sorts, as well as particular modes of entry. But my experience has been that the entries it is advisable to make are too multifarious to be accommodated by the most ingenious formal ruling; unless, indeed, you make the conventional heading "Remarks" disproportionately wide, and commit to it everything not otherwise provided for. My preference is decidedly for a plain page. I use a strongly bound blank book, cap size, containing at least six or eight quires of *good* smooth paper; but smaller may be needed for travelling, even down to a pocket note-book. I would not advise a multiplicity of books, splitting up your record into different departments: let it be journal and register of specimens combined. (The registry of *your own collecting* has nothing to do with the register of your *cabinet of birds*, which is sure to include a proportion of specimens from other sources, received in exchange, donated, or purchased. I speak of this beyond.) I have found it convenient to commence a day's record with a register of the specimens secured, each entry consisting of a duplicate of the bird's label (see beyond), accompanied by any further remarks I have to offer respecting the particular specimens; then to go on with the full of my day's observations, as suggested in the last paragraph. You thus have a "register of collections" in chronological order, told off with an unbroken series of numbers, checked with the routine label-items, and continually interspersed with the balance of your ornithological studies. Since your private field-number is sometimes an indispensable clew to the authentication of a specimen after it has left your own hands, *never duplicate it*. If you are collecting other objects of natural history besides birds, still have

but one series of numbers; duly enter your mammal, or mineral, or whatever it is, in its place, with the number under which it happens to fall. Be scrupulously accurate with these and all other *figures*, as of dates and measurements. Always use black ink; the "fancy" writing-fluids, even the useful carmine, fade sooner than black, while lead-pencilling is never safe.

Labelling. — This should *never* be neglected. It is enough to make a sensitive ornithologist shiver to see a specimen without that indispensable appendage — a label. I am sorry to observe that the routine labelling of most collections is far from being satisfactory. A well-appointed label is something more than a slip of paper with the bird's name on it, and is still defective, if, as is too often the case, only the locality and collector are added. A complete label records the following particulars: 1. *Title* of the survey, voyage, exploration, or other expedition (if any), during which the specimen was collected. 2. *Name* of the person in charge of the same (and it may be remarked that the less he really cares about birds, and the less he actually interests himself to procure them, the more particular he will be about this). 3. *Title* of the institution or association (if any) under the auspices or patronage of which the specimen was procured, or for which it is designed. 4. *Name of collector;* partly to give credit where it is due, but principally to fix responsibility, and authenticate the rest of the items. 5. *Collector's number*, referring to his note-book, as just explained; if the specimen afterwards forms part of a general collection it usually acquires another number by new registry; the collector's then becoming the "original," as distinguished from the "current," number. 6. *Locality*, perhaps the most important of all the items. A specimen of unknown or even uncertain origin is worthless or nearly so; while lamentable confusion has only too often arisen in ornithological writings from vague or erroneous indications of locality: I should say that a specimen "not authentic" in this particular had better have its *supposed* origin erased and be let alone. Nor will it do to say simply, for instance, "North America" or even "United States." The general geographical distribution of birds being according to recognized faunal areas, ornithologists generally know already the quarter of the globe from which any bird comes; the locality of particular specimens, therefore, should be fixed down to the very spot. If this be obscure add the name of the nearest place to be found on a fairly good map, giving distance and direction. 7. *Date of collection*, — day of the month, and year. Among other reasons for this may be mentioned the fact that it is often important to know what season a particular plumage indicates. 8. *Sex*, and if possible also *age*, of the specimen, — an item that bespeaks its own importance. Ornithologists of all countries are agreed upon certain signs to indicate sex. These are: ♂ for *male*, ♀ for *female*, — the symbols respectively of Mars and Venus. Immaturity is often denoted by the sign ☌; thus, ♂☌, young male. Or, we may write ♀ *ad.*, ♀ *yg.*, for adult female, young female, respectively. It is preferable, however, to use the language of science, not our vernacular, and say ♂ *juv.* (*juvenis*, young). "*Nupt.*" signifies breeding plumage; "*hornot.*" means a bird of the year. 9. *Measurements* of length, and of extent of wings; the former can only be obtained approximately, and the latter not at all, from a prepared specimen. 10. *Color* of the eyes, and of the bill, feet, or other naked or soft parts, the tints of which may change in drying. 11. *Miscellaneous particulars*, such as contents of stomach, special circumstances of capture, vernacular name, etc. 12. *Scientific name of the bird.* This is really the least important item of all, though generally thought to take precedence. But a bird labels itself, so to speak; and nature's label may be deciphered at any time. In fact, I would enjoin upon the collector *not* to write out the supposed name of the bird in the field, unless the species is so well known as to be absolutely unquestionable. Proper identification, in any case to which the slightest doubt may attach, can only be made after critical study in the closet with ample facilities for examination and comparison. The first eight items, and the twelfth, usually constitute the

face of a label; the rest are commonly written on the back. Labels should be of light cardboard, or very stiff writing paper; they may be dressed attractively, as fancy suggests; the general items of a large number of specimens are best printed; the special ones must of course be written. Shape is immaterial; small "cards" or "tickets" are preferred by some, and certainly look very well when neatly appointed; but I think, on the whole, that a shape answering the idea of a "slip" rather than a "ticket" is most eligible. A slip about three inches long and two thirds of an inch wide will do very well for anything, from a hawk to a humming-bird. Something like the "shipping tag" used by merchants is excellent, particularly for larger objects. It seems most natural to attach the string to the *left-hand* end. The slip should be tied so as to swing just clear of the bird's legs, but *not* loose enough to dangle several inches, for in that case the labels are continually tangling with each other when the birds are laid away in drawers. The following diagrams show the face and back of the last label I happened to write before these lines were originally penned; they represent the size and shape that I find most convenient for general purposes; while the "legend" illustrates every one of the twelve items above specified.

Smithsonian Explorations in Dakota. Dr. Elliott Coues, U. S. A. Institution.

No. 2655. Buteo borealis (Gm.) V. ♀ juv.

Fort Randall, Missouri River. Oct. 29, 1872.

Obverse.

23.00 × 53.00 × 17.50. — Eyes yellowish-gray; bill horn-blue, darker at tip; cere wax-yellow; tarsi dull yellowish; claws bluish-black. Stomach contained portions of a rabbit; also, a large tapeworm.

Reverse.

Directions for Measurement may be inserted here, as this matter pertains rightfully to the recording of specimens. The following instructions apply not only to length and extent, but to the principal other dimensions, which may be taken at any time. For large birds, a tape-line showing inches and fourths will do; for smaller ones, a foot-rule graduated for inches and eighths, or better, decimals to hundredths, must be used; and for all nice measurements the dividers are indispensable. "*Length:*" Distance between the tip of the bill and end of the longest tail-feather. Lay the bird on its back on the ruler on a table; take hold of the bill with one hand and of both legs with the other; pull with reasonable force to get the curve all out of the neck; hold the bird thus with the tip of the bill flush with one end of the ruler, and see where the end of the tail points. Put the tape-line in place of the ruler, in the same way, for larger birds. "*Extent:*" Distance between the tips of the outspread wings. They must be *fully* outstretched, with the bird on its back, crosswise on the ruler, its bill pointing to your breast. Take hold of right and left metacarpus with the thumb and forefinger of your left and right hand respectively, *stretch* with reasonable force, getting one wing-tip flush with one end of the ruler, and see how much the other wing-tip reaches. With large birds pull away as hard as you please, and use the table, floor, or side of the room; mark the points and apply tape-line. "*Length of wing:*" Distance from the carpal angle formed at the bend of the wing to the end of the longest primary. Get it with compasses for small birds. In birds with a convex wing, do not lay the tape-line over the curve, but under the wing in a straight line. This measurement is the one called, for short, "the wing." "*Length of tail:*" Distance

from the roots of the rectrices to the end of the longest one. Feel for the pope's nose; in either a fresh or dried specimen there is more or less of a palpable lump into which the tail-feathers stick. Guess as near as you can to the middle of this lump; place the end of the ruler opposite this point, and see where the tip of the longest tail-feather comes. "*Length of bill:*" Some take the curve of the upper mandible; others the side of the upper mandible from the feathers; others the gape, etc. I take the *chord of the culmen.* Place one foot of the dividers on the culmen just where the feathers end; no matter whether the culmen runs up on the forehead, or the frontal feathers run out on the culmen, and no matter whether the culmen is straight or curved. Then with me the *length of the bill* is the shortest distance from the point just indicated to the tip of the upper mandible; measure it with the dividers. In a straight bill of course it is the length of the culmen itself; in a curved bill, however, it is quite another thing. "*Length of tarsus:*" Distance between the joint of the tarsus with the leg above, and that with the first phalanx of the middle toe below. Measure it *always* with dividers, and in *front* of the leg. "*Length of toes:*" Distance in a straight line along the upper surface of a toe from the point last indicated to the root of the claw on top. Length of toe is to be taken *without* the claw, unless otherwise specified. "*Length of the claws:*" Distance in a *straight line* from the point last indicated to the tip of the claw. "*Length of head*" is often a convenient dimension for comparison with the bill. Set one foot of the dividers over the base of the culmen (determined as above) and allow the other to slip snugly down over the arch of the occiput.

§ 6. — INSTRUMENTS, MATERIALS, AND FIXTURES FOR PREPARING BIRDSKINS.

Instruments. — The only indispensable instrument is a pair of scissors *or* a knife; although practically you want both of these, a pair of spring forceps, and a knitting-needle, or some similar wooden or ivory object, yet I have made hundreds of birdskins consecutively without touching another tool. "*Persicos odi, puer, apparatus!*" I always mistrust the emphasis of a collector who makes a flourish of instruments. You might be surprised to see what a meagre, shabby-looking kit our best taxidermists work with. Stick to your scissors, knife, forceps, and needle. But you may as well buy, at the outset, a common dissecting-case, just what medical students begin business with; it is very cheap, and if there are some unnecessary things in it, it makes a nice little box in which to keep your tools. The case contains, among other things, several scalpels, just the knives you want; a "cartilage-knife," which is nothing but a stout scalpel, suitable for large birds; the best kind of scissors for your purpose, with short blades and long handles — if "kneed" at the hinge so much the better; spring forceps, the very thing; a blow-pipe, useful in many ways and answering well for a knitting-needle; and some little steel-hooks, chained together, which you may want to use. But you will also require, for large birds, a very heavy pair of scissors, or small shears, short-bladed and long-handled, and a stout pair of bone-nippers. Have some pins and needles; surgical needles, which cut instead of punching, are the best. Get a hone or strop, if you wish, and a feather duster. Use of scissors requires no comment, and I would urge their habitual employ instead of the knife-blade; I do nine-tenths of my cutting with scissors, and find it much the easiest. A double-lever is twice as effective as a single one, and besides, you gain in cutting soft, yielding substances by opposing two blades. Moreover, scalpels need constant sharpening; mine are generally too dull to cut much with, and I suppose I am like other people — while scissors stay sharp enough. The flat, thin ivory or ebony *handle* of the scalpel is about as useful as the blade. Finger-nails, which were made before scalpels, are a mighty help. Forceps are almost indispensable for seizing and holding parts too small or too remote to be grasped by the fingers. The knitting-needle is wanted for a specific purpose noted beyond. The shears or nippers are only needed for what the ordinary scissors are too weak to do. Our instruments, you see now, are "a short horse soon curried."

Materials. — (*a.*) *For stuffing.* "What do you stuff 'em with?" is usually the first question of idle curiosity about taxidermy, as if that were the great point; whereas, the stuffing is so small a matter that I generally reply, "anything, except brickbats!" But if stuffing birds were the final cause of *Cotton*, that admirable substance could not be more perfectly adapted than it is to the purpose. Ordinary raw cotton-batting or wadding is what you want. When I can get it I never think of using anything else for small birds. I would use it for all birds were expense no object. Here *tow* comes in; there is a fine, clean, bleached article of tow prepared for surgical dressings; this is the best, but any will do. Some say chop your tow fine; this is harmless, but unnecessary. A crumpled newspaper, wrapped with tow, is first-rate for a large bird. Failing cotton or tow, any *soft, light, dry, vegetable substance* may be made to answer, — rags, paper, crumbled leaves, fine dried grass, soft fibrous inner bark, etc.; the down of certain plants, as thistle and silkweed, makes an exquisite filling for small birds. But I will qualify my remark about brickbats by saying: *never put hair, wool, feathers, or any other* ANIMAL *substance in a birdskin;* far better leave it empty: for, as we shall see in the sequel, bugs come fast enough, without being invited into a snug nest. (*b.*) *For preserving.* ARSENIC, — not the pure metal properly so called, but arsenic of the shops, or arsenious acid, — is the great preservative. Use dry powdered arsenic, plenty of it, and nothing else. There is no substitute for arsenic worthy of the name, and no preparation of arsenic so good as the simple substance. Various kinds of "arsenical soap" were and may still be in vogue; it is a nasty greasy substance, not fit to handle; and although efficacious enough, there is a very serious hygienic objection to its use.[1] Arsenic, I need not say, is a violent irritant poison, and must therefore be duly *guarded*, but may be used with perfect impunity. It is a very *heavy* substance, not appreciably volatile at ordinary temperatures, and therefore not liable, as some suppose, to be breathed, to any perceptible, much less injurious, extent. It will not even at once enter the pores of healthy unbroken skin; so it is no matter if it gets on the fingers. The exceedingly minute quantity that may be supposed to find its way into the system in the course of time is believed by many competent physicians to be rather beneficial as a tonic. I will not commit myself to this; for, though I have never felt better than when working daily with arsenic, I do not know how much my health was improved by the out-door exercise always taken at the same time. The simple precautions are, not to let it lie too long in contact with the skin, nor get into an abrasion, nor under the nails. It will convert a scratch or cut into a festering sore of some little severity; while if lodged under the nails it soon shows itself by soreness, increased by pressure; a white speck appears, then a tiny abscess forms, discharges and gets well in a few days. Your precautions really respect other persons more than yourself; the receptacle should be conspicuously labelled "POISON!" Arsenic is a good friend of ours; besides preserving our birds, it keeps busybodies and meddlesome folks away from the scene of operations, by raising a wholesome suspicion of the taxidermist's surroundings. It may be kept in the tin pots in which it is usually sold; but some shallower, *broader* receptacle is more convenient. A little drawer say 6×6 inches, and an inch deep, to slip under the edge of the table, or a similar compartment in a large drawer, will be found handy. A salt-spoon, or little wooden shovel whittled like one, is nice to use it with, though in effect, I always shovel it up with the handle of a scalpel. As stated, there is no substitute for arsenic;

[1] "Strange as it may appear to some, I would say avoid especially all the so-called arsenical soaps; they are at best but filthy preparations; besides, it is a fact to which I can bear painful testimony that they are, especially when applied to a greasy skin, poisonous in the extreme. I have been so badly poisoned, while working upon the skins of some fat water birds that had been prepared with arsenical soap, as to be made seriously ill, the poison having worked into the system through some small wounds or scratches on my hand. Had pure arsenic been used in preparing the skins, the effect would not have been *as bad*, although grease and arsenic are generally a blood-poison in *some* degree; but when combined with 'soap' the effect, at least as far as my experience goes, is much more injurious." (MAYNARD, *Guide*, p. 12.) In endorsing this, I would add that the combination is the more poisonous, in all probability, simply because the soap, being detersive, mechanically facilitates the entrance of the poison, without, however, chemically increasing its virulence.

but at a pinch you can make temporary shift with the following, among other articles: — table salt, or saltpetre, or charcoal strewn plentifully; strong solution of corrosive sublimate, brushed over the skin inside; creosote; impure carbolic acid; these last two are quite efficacious, but they smell horribly for an indefinite period. A bird threatening to decompose before you can get at it to skin, may be saved for a while by squirting weak carbolic acid or creosote down the throat and up the fundament; or by disembowelling, and filling the cavity with powdered charcoal. (*c.*) *For cleansing.* *Gypsum* is an almost indispensable material for cleansing soiled plumage. "Gypsum" is properly native hydrated sulphate of lime; the article referred to is "plaster of Paris" or gypsum heated up to 260° F. (by which the water of crystallization is driven off) and then finely pulverized. When mixed with water it soon solidifies, the original hydrate being again formed. The mode of using it is indicated beyond. It is most conveniently kept in a shallow tray, say a foot square, and an inch or two deep, which had better, furthermore, slide under the table as a drawer; or form a compartment of a larger drawer. *Keep gypsum and arsenic in different-looking receptacles,* not so much to keep from poisoning yourself, as to keep from *not* poisoning a birdskin. They look much alike, and skinning becomes such a mechanical process that you may get hold of the wrong article when your thoughts are wandering in the woods. Gypsum, like arsenic, has no worthy rival in its own field; some substitutes, in the order of their applicability, are: — corn-meal, probably the best thing after gypsum; calcined magnesia (very good, but too light — it floats in the air, and makes you cough); bicarbonate of magnesia; powdered chalk ("prepared chalk," *creta præparata* of the drug shops, is the best kind); fine wood-ashes; clean dry loam. No article, however powdery when dry, that contains a glutinous principle, as for instance gum-arabic or flour, is admissible. (*d.*) *For wrapping,* you want a thin, pliable, strong paper; water-closet paper is the very best; newspaper is pretty good. For making the cones or cylinders in which birdskins may be set to dry, a stiffer article is required; writing paper answers perfectly.

Naturalists habitually carry a Pocket Lens, much as other people do a watch. You will find a magnifying glass very convenient in your search for the sexual organs of small birds when obscure, as they frequently are, out of the breeding season; in picking lice from plumage, to send to your entomological friend, who will very likely pronounce them to be of a "new species;" and for other purposes.

Fixtures. When travelling, your fixtures must ordinarily be limited to a collecting-chest; you will have to skin birds on the top of this, on the tail-board of a wagon, or on your lap, as the case may be. The chest should be very substantial — iron-bound is best; strong as to hinges and lock — and have handles. A good size is $30 \times 18 \times 18$ inches. Let it be fitted with a set of trays; the bottom one say four inches deep; the rest shallower; the top one very shallow, and divided into compartments for your tools and materials, unless you fix these on the under side of the lid. Start out with all the trays full of cotton or tow. At home, have a room to yourself, if possible; taxidermy makes a mess to which your wife may object, and arsenic must not come in the way of children. At any rate have your own table. I prefer plain deal that may be *scrubbed* when required; great cleanliness is indispensable, especially when doing much work in hot weather, for the place soon smells sour if neglected. I use no special receptacle for offal, for this only makes another article to be cleaned; lay down a piece of paper for the refuse, and throw the whole away. A perfectly smooth surface is desirable. I generally have a large pane of window-glass on the table before me. It will really be found advantageous to have a scale of inches scratched on the edge of the table; only a small part of it need be fractionally subdivided; this replaces the foot-rule and tape-line, just as the tacks of a dry-goods counter answer for the yardstick. You will find it worth while to rig some sort of a derrick arrangement, which you can readily devise, on one end of the

table, to hitch your hook to, if you hang your birds up to skin them; they should swing clear of everything. The table should have a large general drawer, with a little drawer for gypsum and arsenic already mentioned, unless these be kept elsewhere. Stuffing may be kept in a box under the table, and make a nice footstool; or in a bag slung to the table leg.

Query: Have you cleansed the bird's plumage? Have you plugged the mouth, nostrils, and vent? Have you measured the specimen and noted the color of the eyes, bill, and feet, and prepared the labels, and made the entry in the register? Have you got all your apparatus within arm's length? Then we are ready to proceed.

§ 7. — HOW TO MAKE A BIRDSKIN.

a. The Regular Process.

Lay the Bird on its Back, the bill pointing to your right[1] elbow. Take the scalpel like a pen, with edge of blade uppermost, and run a straight furrow through the feathers along the middle line of the belly, from end of the breast-bone to the vent. Part the feathers completely, and keep them parted.[2] Observe a strip of skin either perfectly naked, or only covered with short down; this is the line for incision. Take scissors, stick in the pointed blade just over the end of the breast-bone, cut in a straight line thence to and *into* the vent; cut extremely shallow.[3]

Take the forceps in your left hand, and scalpel in your right, both held pen-wise, and with the forceps seize and lift up one of the edges of the cut skin, gently pressing away the belly-walls with the scalpel-point; no cutting is required; the skin may be peeled off without trouble. Skin away till you meet an obstacle; it is the thigh. Lay down the instruments; with your left hand take hold of the leg outside at the shank; put your right forefinger under the raised flap of skin, and feel a bump; it is the *knee;* push up the leg till this bump comes into view; hold it so. Take the scissors in your right hand; tuck one blade under the concavity of the knee, and sever the joint at a stroke; then the thigh is left with the rest of the body, while the rest of the leg is dissevered and hangs only by skin. Push the leg further up till it has slipped out of its sheath of skin, like a finger out of a glove, down to the heel-joint. You have now to clear off the flesh and leave the bone there; you may scrape till this is done, but there is a better way. Stick the *closed* points of the scissors in among the muscles just below the head of the bone, then separate the blades just wide enough to grasp the bone; snip off its head; draw the head to one side; all the muscles follow, being there attached; strip them *downward* from the bone; the bone is left naked, with the muscle hanging by a bundle of tendons ("leaders") at its foot; sever these tendons collectively at a stroke. This whole performance will occupy about three seconds, after practice; and you may soon discover you can nick off the head of the bone of a small bird with the thumb-nail. Draw the leg bone back into its sheath, and leave it. Repeat all the foregoing steps on the other side of the bird. If you are bothered by the skin-flaps settling against the belly-walls, insert a fluff of cotton.

[1] Reverse this and following directions for *position*, if you are left-handed.

[2] The motion is exactly like stroking the right and left sides of a moustache apart; you would never dress the hairs smoothly away from the middle line, by poking from ends to root; nor will the feathers stay aside, unless stroked away from base to tips.

[3] The skin over the belly is thin as tissue paper in a small bird; the chances are you will at first cut the walls of the belly too, opening the cavity; this is no great matter, for a pledget of cotton will keep the bowels in; nevertheless, try to divide skin only. Reason for cutting *into* vent: this orifice makes a nice natural termination of the incision, buttonhole-wise, and may keep the end of the cut from tearing around the root of the tail. Reason for beginning to cut *over* the edge of the sternum: the muscular walls of the belly are very thin, and stick so close to the skin that you may be in danger of attempting to remove them with the skin, instead of removing the skin from them; whereas, you cannot remove anything but skin from over the breast bone, so you have a guide at the start. You can tell skin from belly-wall, by its livid, translucent whitishness instead of redness.

Keep the feathers out of the wound; cotton and the moustache movement will do it. Next you must sever the tail from the body, leaving a small "pope's-nose" for the feathers to stay stuck into. Put the bird in the hollow of your lightly closed left hand, tail upward, belly toward you; or, if too large for this, stand it on its breast on the table in similar position. Throw your left forefinger across the front of the tail, pressing a little backward; take the scissors, cut the end of the lower bowel free first, then peck away at bone and muscle with cautious snips, till the tail-stump is dissevered from the rump, and the tail hangs only by skin. You will soon learn to do it all at one stroke; but you cannot be too careful at first; you are cutting right down on to the skin over the top of the pope's-nose, and if you divide this, the bird will part company with its tail altogether. Now you have the rump-stump protruding naked; the legs dangling on either side; the tail hanging loose over the bird's back between them. Lay down scissors, take up forceps[1] in your left hand; with them seize and hold the stump of the rump; and with point or handle of scalpel in the other hand, with finger-tips, or with thumb-nail (best), gently press down on and peel away skin.[2] No cutting will be required (usually) till you come to the wings: the skin peels off (usually) as easily as an orange-rind; as fast as it is loosened, *evert* it; that is make it continually turn itself more and more completely inside out. Work thus till you are stopped by the obtruding wings.[3] You have to sever the wing from the body at the shoulder, just as you did the leg at the knee, and leave it hanging by skin alone. Take your scissors,[4] as soon as the upper arm is exposed, and cut through flesh and bone alike at one stroke, a little below (outside of) the shoulder-joint. Do the same with the other wing. As soon as the wings are severed the body has been skinned to the root of the neck; the process becomes very easy; the neck almost slips out of its sheath of itself; and if you have properly attended to keeping the feathers out of the wound and to continual eversion of the skin, you now find you have a naked body connected dumb-bell-wise by a naked neck to a cap of reversed skin into which the head has disappeared, from the inside of which the legs and wings dangle, and around the edges of which is a row of plumage and a tail.[5] Here comes up an important consideration: the skin, plumage, legs, wings, and tail together *weigh* something, — enough to *stretch*[6] unduly the skin of the neck, from the small cylinder of which they are now suspended; the whole mass must be *supported*. For small birds, gather it in the hollow of your left hand, letting the body swing over the back of your hand out of the

[1] Or at this stage you may instead stick a hook into a firm part of the rump, and hang up the bird about the level of your breast; you thus have both hands free to work with. This is advisable with all birds too large to be readily taken in hand, and will help you, *at first*, with any bird. But there is really no use of it with a small bird, and you may as well learn the best way of working at first as afterward.

[2] The idea of the whole movement is exactly like ungloving your hand from the wrist, by turning the glove inside out to the very finger tips. Some people say, *pull* off the skin; I say *never pull* a bird's skin under any circumstances: *push it off*, always operating at lines of contact of skin with body, never upon areas of skins already detached.

[3] The elbows will get in your way before you reach the point of attack, namely, the shoulder, unless the wings were completely relaxed (as was essential, indeed, if you measured alar expanse correctly). Think what a difference it would make, were you skinning a man through a slit in the belly, whether his arms were stretched above his head, or pinned against his ribs. It is just the same with a bird. When properly relaxed the wings are readily pressed away toward the bird's head, so that the shoulders are encountered before the elbows.

[4] Shears will be required to crash through a *large* arm-bone. Or, you may with the scalpel unjoint the shoulder. The joint will be found higher up and deeper among the breast muscles than you might suppose, unless you are used to carving fowls at table. With a small bird, you may snap the bone with the thumb-nail and tear asunder the muscles in an instant.

[5] You find that the little straight cut you made along the belly has somehow become a hole larger than the greatest girth of the bird; be undismayed; it is all right.

[6] If you have up to this point properly *pushed* off the skin instead of *pulling* it, there is as yet probably no stretching of any consequence; but, in skinning the head, which comes next, it is almost impossible for a beginner to avoid stretching to an extent involving great damage to the good looks of a skin. Try your utmost, by delicacy of manipulation at the lines of contact of skin with flesh, and only there, to prevent *lengthwise* stretching. Crosswise distension is of no consequence; in fact more or less of it is usually required to skin the head, and it tends to counteract the ill effect of undue elongation.

way; for large ones, rest the affair on the table or your lap. To skin the head, secure the body in the position just indicated, by confining the neck between your left thumb and forefinger; bring the right fingers and thumb to a cone over the head, and draw it out with gentle force; or, holding the head itself between the left thumb and forefinger, insert the handle of the scalpel between the skin and skull, and pry a little, to enlarge the neck-cylinder of skin enough to let the head pass. It will generally[1] slip out of its hood very readily, as far as its greatest diameter;[2] there it sticks, being in fact pinned by the *ears*. Still holding the bird as before, with the point of the scalpel handled like a nut-picker, or with your thumb-nail, detach the delicate membrane that lines the ear-opening; do the same for the other ear. The skull is then shelled out to the *eyes*, and will skin no further of its own accord, being again attached by a membrane, around the border of the eye-socket. Holding the scalpel as before, run its edge around an arc (a semicircle is enough to let you into the orbit) of the circumference, dissevering the membrane from the bone. Reverse the scalpel, and scoop out the eyeball with the end of the handle; you bring out the eye betwixt the ball of your thumb and the handle of the instrument, tearing apart the optic nerve and the conjunctival tissue, but taking care not to open the eyeball[3] or lacerate the eyelids. Do the same with the other eye. The head is then skinned far enough; there is no use of getting *quite* to the base of the bill. You have now to get rid of the brain and flesh of the nape and jaws,[4] and leave most of the skull in; the cranial dome makes the only perfect "stuffing" for the skin of the head. This is all done at once by only four particular cuts. Hold the head between your left thumb and fingers, the bill pointing towards you, the bird's palate facing you; you observe a space bounded behind by the base of the skull where the neck joins, in front by the floor of the mouth, on either side by the prongs of the under jaw, — these last especially prominent. Take the scissors; stick one blade just inside one branch of the lower jaw, thence into the eye-socket which lies below (the head being upside down), thence into the brain-box; make a cut parallel with the jaw, just inside of it, bringing the upper scissor blade perpendicularly downward, crashing through the skull just inside of the angle of the jaw. Duplicate this cut on the other side. Connect the anterior ends of these cuts by a transverse one across the floor and roof of the mouth. Connect the posterior ends of the side cuts by one across the back of the skull near its base, — just where the nape-muscle ceases to override the cranium. You have enclosed and cut out a squarish-shaped mass of bone and muscle, and, on gently pulling the neck (to which of course it remains attached), the whole affair comes out, bringing the brain with it, but leaving the entire roof of the skull supported on a scaffolding of jaw-bone. It only remains to skin the wings. Seize the arm-stump with fingers or forceps; the upper arm is readily drawn from its sheath as far as the elbow; but the wing must be skinned to the wrist (carpus — "bend of the wing"); yet it will not come out so easily, because the secondary quills grow to one of the fore-arm bones (the ulna), pinning down the skin the whole way along a series of points. To break up these connections, hold the upper arm firmly with the left thumb and forefinger, the convexity of the elbow looking towards you; press the right thumb-nail closely against the back edge of the ulna, and strip downward, scraping the bone with the nail the whole way. If you only hit the line of adhesions, there is no trouble at all about this. Now you want to

[1] The special case of head too large for the calibre of the neck is treated beyond.

[2] And you will at once find a great apparent increase of amount of free skin in your hand, owing to release and extension of all that was before shortened in length by circular distension, in enlargement of the neck-cylinder.

[3] An eyeball is much larger than it looks from the outside; if you stick the instrument straight into the socket, you may punch a hole in the ball and let out the water; a very disagreeable complication. Insinuate the knife-handle close to the rim of the socket, and hug the wall of the cavity throughout.

[4] You may of course at this stage cut off the neck at the nape, punch a hole in the base of the skull, dig out the brains, and scrape away at the jaw-muscles till you are satisfied or tired; an unnecessary job, during which the skin may have become dry and shrivelled and hard to turn right side out. The operation described in the text may require ten seconds, perhaps.

leave in one of the two fore-arm bones, to preserve sufficiently the shape of the limb, but to remove the other, with the upper-arm bone and all the flesh. It is done in a moment: stick the point of the scissors between the heads of the two fore-arm bones, and cut the hinder one (ulna) away from the elbow; then the other fore-arm bone (radius), bearing on its near end the elbow and the whole upper arm, is to be stripped away from the ulna, taking with it the flesh of the fore-arm, and to be cut off at its far end close to the wrist-joint, one stroke severing the bone and all the tendons that pass over the wrist to the hand; then the ulna, bare of flesh, is alone left in, attached at the wrist. Draw gently on the wing from the outside till it slips into the natural position whence you everted it. Do the same for the other wing. This finishes the skinning process. The skin is now to be turned right side out. Begin any way you please, till you see the point of the bill reappearing among the feathers; seize it with fingers or forceps, as convenient, and use it for gentle traction. But by no means pull it out by holding on to the rear end of the skin — that would infallibly stretch the skin. Holding the bill, make a cylinder of your left hand and coax the skin backward with a sort of milking motion. It will come easily enough, until the final stage of getting the head back into its skull-cap; this may require some little dexterity; but you cannot fail to get the head in, if you remember what you did to get it out. When this is fairly accomplished, you for the first time have the pleasure of seeing something that looks like a birdskin. Your next[1] care is to apply arsenic. Lay the skin on its back, the opening toward you and wide spread, so the interior is in view. Run the scalpel-handle into the neck to dilate that cylinder until you can see the skull; find your way to the orifices of the legs and wings; expose the pope's-nose; thus you have not only the general skin surface, but all the points where some traces of flesh were left, fairly in view. Shovel in arsenic; dump some down the neck, making sure it reaches and plentifully besprinkles the whole skull; drop a little in each wing hole and leg hole; leave a small pile at the root of the tail; strew some more over the skin at large. The simple rule is, put in as much arsenic as will *stick* anywhere. Then close the opening, and shake up the skin; move the head about by the bill; rustle the wings and move the legs; this distributes the poison thoroughly. If you have got in more than is necessary, as you may judge by seeing it piled up dry, anywhere, hold the skin with the opening downward over the poison-drawer, and give it a flip and let the superfluous powder fall out. Now for the "make up," upon which the beauty of the preparation depends. First get the empty skin into good shape. Let it lie on its back; draw it straight out to its natural length. See that the skin of the head fits snugly; that the eyes, ears, and jaws are in place. Expand the wings to make sure that the bone is in place, and fold them so that the quills override each other naturally; set the tail-feathers shinglewise also; draw down the legs and leave them straddling wide apart. Give the plumage a preliminary dressing; if the skin is free from kinks and creases, the feathers come naturally into place; particular ones that may be awry should be set right, as may be generally done by stroking, or by lifting them free repeatedly, and letting them fall; if any (through carelessness) remain turned into the opening, they should be carefully picked out. Remove all traces of gypsum or arsenic with the feather duster. The stuffing is to be put in through the opening in the belly; the art is to get in just enough, in the right places. It would never do to push in pellets of cotton, as you would stuff a pillow-case, till the skin is filled up; no subsequent skill in setting could remove the distortion that would result. It takes just *four*[2] pieces of stuffing — one for each eye, one for the neck, and one for the body;

[1] Some direct the poisoning to be done while the skin is still wrong side out; and it may be very thoroughly effected at that stage. I wait, because the arsenic generally strews over the table in the operation of reversing the skin, if you use as much as I think advisable; and it is better to have a cavity to put it *into* than a surface to strew it *on*.

[2] For any ordinary bird up to the size of a crow. It is often directed that the leg-bones and wing-bones be wrapped with cotton or tow. I should not think of putting anything around the wing-bones of any bird up to the size of an eagle, swan, or pelican. Examination of a skinned wing will show how extremely compact it is, except

while it requires rather less than half as much stuffing as an inexperienced person might suppose. Take a shred of cotton that will make a tight ball as large as the bird's eye; stick it on the end of your knitting-needle, and by twirling the needle whilst the cotton is confined in your finger tips, you make a neat ball. Introduce this through the belly-opening, into the eye-socket; if you have cut away skull enough, as already directed, it will go right in; disengage the needle with a reverse twirl, and withdraw it. Take hold of the bill with one hand, and with the forceps in the other, dress the eyelids neatly and naturally over the elastic substance within. Repeat for the other eye. Take next a shred of cotton that will roll into a firm cylinder rather less than the size of the bird's neck. Roll it on the needle much as you did the eye-ball, introduce it in the same way, and ram it firmly into the base of the skull; disengage the needle by twirling it the other way, and withdraw it, taking care not to dislodge the cotton neck. If now you peep into the skin you will see the end of this artificial neck; push it up against the skin of the breast, — it must not lie down on the back between the shoulders.[1] The body-wad comes next; you want to imitate the size and shape of the bird's trunk. Take a mass of cotton you think will be enough, and take about *half* of this; that will be plenty (cotton is very elastic). It should make a tolerably firm ball, rather egg-shaped, swelling at the breast, smaller behind. If you simply squeeze up the cotton, it will not stay compressed; it requires a motion something like that which bakers employ to knead dough into the shape of a loaf. Keep tucking over the borders of the cotton till the desired shape and firmness are attained. Insert the ball between the blades of the forceps in such way that the instrument confines the folded-over edges, and with a wriggling motion insinuate it aright into the body. Before relaxing the forceps, put your thumb and forefinger in the bird's armpits, and pinch the shoulders together till they almost touch; this is to make sure that there is no stuffing between the shoulders, — the whole mass lying breastwards. Loosen the forceps and withdraw them. If the ball is rightly made and tucked in, the elasticity of the cotton will chiefly expend itself in puffing out the breast, which is just what is wanted. Be careful not to push the body *too far* in; if it impacts against the skin of the neck, this will infallibly stretch, driving the shoulders apart, and no art will remedy the unsightly gape resulting. You see I dwell on this matter of the shoulders; the whole knack of stuffing correctly focuses just over the shoulders. If you find you have made the body too large, pull it out and make a smaller one; if it fits nicely about the shoulders, but is too long to go in, or too puffy over the belly, let it stay, and pick away shreds at the open end till the redundancy is remedied. Your bird is now stuffed. Close the opening by bringing the edges of the original cut together. There is no use of sewing[2] up the cut, for a small bird; if the stuffing is correct, the feathers will hide the opening; and if they do not, it is no matter. You are not making an object for a show case, but for a naturalist's

just at the shoulder. What you remove will never make any difference from the outside, while you would almost inevitably get in too much, not of the right shape, and make an awkward bulging no art would remedy; I say, then, leave the wings of all but the largest birds *empty*, and put in very little under any circumstances. As for legs, the whole host of small perching birds need no wrapping whatever; depend upon it you will make a nicer skin without wrapping. But large birds and those with very muscular or otherwise prominent legs must have the removal of flesh compensated for. I treat of these cases beyond.

[1] Although a bird's neck is really, of course, in direct continuation of the back-bone, yet the natural sigmoid curve of the neck is such that it virtually takes departure rather from the breast, its lower curve being received between the prongs of the merrythought. This is what we must imitate instead of the true anatomy. If you let the end of the neck lie between the shoulders, it will infallibly press them apart, so that the interscapular plumage cannot shingle over the scapular feathers as it should, and a gaping place, showing down or even naked skin, will result. Likewise if the neck be made *too large* (the chances are that way, at first), the same result follows. These seemingly trifling points are very important indeed; I never made a decent birdskin till I learned to get the neck small enough and to shove the end of it against the breast.

[2] But sew it up, if you please, though you may be perhaps giving the man who subsequently mounts the bird the trouble of ripping out the stitches. Stitches, however, will not come amiss with a *large* bird. I generally, in such cases, *pin* the edges of the cut in one or more places.

cabinet. Supposing you to have been so far successful, little remains to be done; the skin already looks very much like a dead bird; you have only to give the finishing touches, and "set" it. Fixing the wings nicely is a great point. Fold each wing closely; see that the carpal bend is well defined, that the coverts show their several oblique rows perfectly, that all the quills override each other like shingles. Tuck the folded wings close up to the body — rather on the bird's back than along its sides; see that the wing tips meet over the tail (*under* the tail as the bird lies on its back); let the carpal angle nestle in the plumage; have the shoulders close together, so that the interscapulars shingle over the scapulars. If the wing be pressed in *too* tightly, the scapulars will rise up on end; there must be neither furrow nor ridge about the insertion of the wings; everything must lie perfectly smooth. At this stage of the process, I generally lift up the skin gingerly, and let it slip head first through one hand after the other, pressing here or there to correct a deformity, or uniformly to make the whole skin compact. The wings set, next bring the legs together, so that the bones within the skin lie parallel with each other; bend the heel-joint a little, to let the tarsi *cross* each other about their middle; lay them sidewise on the tail, so that the naturally flexed toes lie flat, all the claws mutually facing each other. See that the neck is perfectly straight, and, if anything, shortened rather than outstretched; have the crown of the head flat on the table, the bill pointing straight forward,[1] the mandibles shut tightly.[2] Never attempt any "fancy" attitudes with a birdskin; the simpler and more compactly it is made up the better.[3] Finally, I say, hang over your bird (if you have time); dress better the feathers that were well dressed before; perfect every curve; finish caressingly, and put it away tenderly, as you hope to be shriven yourself when the time comes.

There are several ways of laying a birdskin. A common, easy, and slovenly way is to thrust it head first into a paper *cone;* but it makes a hollow-chested, pot-bellied object, unpleasant to see, and renders your nice work on the make-up futile. A paper *cylinder*, corresponding in calibre to the greatest girth of the birdskin, binds the wings well, and makes a good ordinary specimen, — perhaps better than the average. Remarking that there are some detestable practices, such as hanging up a bird by a string through the nose (methods only to be mentioned to be condemned), I will tell you the easiest and best way, by which the most elegant and tasteful results are almost necessarily secured. The skins are simply laid away in cotton, just as they come from your hands. Take a considerable wad of cotton, make a "bed" of it, lay the specimen in, and tuck it up nicely around the edges. In effect, I generally take a thin sheet of cotton wadding, the sizing of which confers some textile consistency, and wrap the bird completely but lightly in it. By loosening or tightening a trifle here or there, laying down a "pillow" or other special slight pressure, the most delicate contour-lines may be preserved with perfect fidelity. Unnecessary pother is sometimes made about *drying*

[1] Exceptions. Woodpeckers, ducks, and some other birds treated of beyond, are best set with the head flat on one side, the bill pointing obliquely to the right or left; owls, with the bill pointing straight up in the air as the bird lies on its back.

[2] If the mandibles gape, run a thread through the nostrils and tie it tightly under the bill. Or, since this injures the nostrils (and we frequently want to examine their structure) stick a pin in under the bill close to the gonys, driving it obliquely into the palate. Sometimes the skin of the throat looks sunken betwixt the sides of the jaw. A shred of cotton introduced with forceps through the mouth will obviate this.

[3] Don't cock up the head, trying to impart a knowing air — it cannot be done, and only makes the poor bird look ridiculous. Don't lay the skin on one side, with the legs in perching position, and don't spread the wings — the bird will never perch nor fly again, and the suggestion is unartistic because incongruous. The only permissible departure from the rule of severe simplicity is when some special ornament, as a fine crest, may be naturally displayed, or some hidden markings are desired to be brought out, or a shape of tail or wing to be perpetuated; but in all such cases the "flowery" inclination should be sparingly and judiciously indulged. It is, however, frequently desirable to give some special set to *hide a defect*, as loss of plumage, etc.; this may often be accomplished very cunningly, with excellent result. No rules for this can be laid down, since the details vary in every case; but in general the weak spot may be hidden by contracting the skin of the place, and then setting the bird in an attitude that naturally corresponds, thus making a virtue of necessity.

skins; the fact being that under ordinary circumstances they could not be kept from drying perfectly; and they dry in exactly the shape they are set, if not accidentally pressed upon. At sea, however, or during unusually protracted wet weather, they of course dry slowly, and may require some attention to prevent mildew or souring, especially in the cases of very large, thick-skinned, or greasy specimens. Thorough poisoning, and drying by a fire, or placing in the sun, will always answer. Very close packing retards drying. When travelling, or operating under other circumstances requiring economy of space, you must not expect to turn out your collection in elegant order. Perfection of contour-lines can only be secured by putting each specimen away by itself; undue pressure is always liable to produce unhappily *outré* configuration of a skin. Trays in a packing box are of great service in limiting possibilities of pressure; they should be shallow; one four inches deep will take a well stuffed hen-hawk, for example, or accommodate from three to six sparrows a-top of one another. It is well to sort out your specimens somewhat according to size, to keep heavy ones off little ones; though the chinks around the former may usually be economized with advantage by packing in the less valuable or the less neatly prepared of the latter. When limited to a travelling chest, I generally pass in the skins as fast as made, packing them "solid" in one sense, yet hunting up a nice resting-place for each. If each rests in its own cotton coffin, it is astonishing how close they may be laid without harm, and how many will go in a given space; a tray $30 \times 18 \times 4$ inches will easily hold three hundred and fifty birds six inches long. As a tray fills up, the drier ones first put in may be submitted to more pressure. A skin originally dried in good shape may subsequently be pressed perfectly flat without material injury; the only thing to avoid being *contortion*. The whole knack of packing birds corresponds to that of filling a trunk *solidly* full of clothes, as may easily be done without damage to an immaculate shirt-front. Finally, I would say, never put away a bird unlabelled, not even for an hour; you may forget it or die. Never tie a label to a bird's bill, wing, or tail; tie it securely to *both* legs where they cross, and it will be just half as liable to become detached as if tied to one leg only. Never paste a label, or even a number, on a bird's plumage. Never put in glass eyes before mounting. Never paint or varnish a bird's bill or feet. Never replace missing plumage of one bird with the feathers of another — no, not even if the birds came out of the same nest.

b. Special Processes; Complications and Accidents.

The Foregoing Method of procedure is a routine practice applicable to three-fourths if not nine-tenths of the "general run" of birds. But there are several cases requiring a modification of this programme; while several circumstances may tend to embarrass your operations. The principal special conditions may therefore be separately treated to your advantage.

Size. — Other things being equal, a large bird is more difficult to prepare than a small one. In one case, you only need a certain delicacy of touch, easily acquired and soon becoming mechanical; in the other, demand on your strength may be made, till your muscles ache. It takes longer, too;[1] I could put away a dozen sparrows in the time I should spend over an eagle; and I would rather undertake a hundred humming-birds than one ostrich. For

[1] The reader may be curious to know something of the statistics on this score — how long it ought to take him to prepare an ordinary skin. He can scarcely imagine, from his first tedious operations, how expert he may become, not only in beauty of result, but in rapidity of execution. I have seen taxidermists make good small skins at the rate of ten an hour; but this is extraordinary. The quickest work I ever did myself was eight an hour, or an average of seven and a half minutes apiece, and fairly good skins. But I picked my birds, all small ones, well shot, labelled, measured, and plugged beforehand, so that the rate of work was exceptional, besides including only the actual manipulations from first cut to laying away. No one *averages* eight birds an hour, even excluding the necessary preliminaries of cleansing, plugging, etc. Four birds an hour, everything included, is good work. A very eminent ornithologist of this country, and an expert taxidermist, once laid a whimsical wager, that he would skin and stuff a bird before a certain friend of his could pick all the feathers off a specimen of the same kind. I forget the time, but he won, and his friend ate crow, literally, that night.

"large" birds, say anything from a hen-hawk upward, various special manipulations I have directed may be foregone, while however you observe their general drift and intent. You may open the bird as directed, or, turning it tail to you, cut with a knife.[1] Forceps are rarely required; there is not much that is too small to be taken in hand. As soon as the tail is divided, hang up the bird by the rump, so you will have both hands free. Let it swing clear of the wall or table, at any height most convenient. The steel hooks of a dissecting case are not always large enough; use a stout fish-hook with the barb filed off. Work with your nails, assisted by the scalpel if necessary. I know of no bird, and I think there is none, in this country at least, the skin of which is so intimately adherent by fibrous or muscular tissue as to require actual dissecting throughout; a pelican comes, perhaps, as near this as any; but in many cases the knife may be constantly employed with advantage. Use it with long clean sweeping strokes, hugging the skin rather than the body. The knee and shoulder commonly require disarticulation, unless you use bone-nippers or strong shears; the four cuts of the skull may presuppose a very able-bodied instrument, even a chisel. The wings will give you the most trouble, and they require a special process; for you cannot readily break up the adhesions of the secondary quills to the ulna, nor is it desirable that very large feathers should be deprived of this natural support. Hammer or nip off the great head of the upper arm-bone, just below the insertion of the breast muscles; clean the rest of that bone and leave it in. Tie a string around it (what sailors call "two half hitches" gives a secure hold on the bony cylinder), and tie it to the other humerus, inside the skin, so that the two bones shall be rather less than their natural distance apart. After the skin is brought right side out, attack the wings thus: Spread the wing under side uppermost, and secure it on the table by driving a tack or brad through the wrist-joint; this fixes the far end, while the weight of the skin steadies the other. Raise a whole layer of the under wing-coverts, and make a cut in the skin thus exposed, from elbow to wrist, in the middle line between the two forearm bones. Raise the flaps of skin and all the muscle is laid bare; it is to be removed. This is best done by lifting each muscle from its bed separately, slipping the handle of the scalpel under the individual bellies; there is little if any bony attachment except at each end, and this is readily severed. Strew in arsenic; a little cotton may be used to fill the bed of muscle removed from a *very* large bird; bring the flaps of skin together, and smooth down the coverts; you need not be particular to sew up the cut, for the coverts will hide the opening; in fact, the operation does not show at all after the make-up. Stuffing of large birds is not commonly done with only the four pieces already directed. The eyeballs, and usually the neck-cylinder, go in as before; the body may be filled any way you please, provided you do not put in too much stuffing nor get any between the shoulders. All large birds had better have the leg-bones wrapped to nearly natural size. Observe that the leg-muscles do not form a cylinder, but a cone; let the wrapping taper naturally from top to bottom. Attention to this point is necessary for all large or medium-sized birds with naturally prominent legs. The large finely feathered legs of a hawk, for example, ought to be well displayed; with these birds, and also with rails, etc., moreover, imitate the bulge of the thigh with a special wad laid inside the skin. Large birds commonly require also a special wad introduced by the mouth, to make the swell of the throat; this wad should be rather fluffy than firm. As a rule, do not fill out

[1] Certain among larger birds are often opened elsewhere than along the belly, with what advantage I cannot say from my own experience. Various water birds, such as loons, grebes, auks, gulls, and ducks (in fact any swimming bird with dense under plumage) may be opened along the side by a cut under the wings from the shoulder over the hip to the rump; the cut is completely hidden by the make-up, and the plumage is never ruffled But I see no necessity for this; for, as a rule, the belly opening can, if desired, be completely effaced with due care, though a very greasy bird with white under plumage generally stains where opened, in spite of every precaution. Such birds as loons, grebes, cormorants, and penguins are often opened by a cut across the fundament from one leg to the other; their conformation in fact suggests and favors this operation. I have often seen water birds slit down the back; but I consider it very poor practice.

large birds to their natural dimensions; they take up too much room. Let the head, neck, and legs be accurately prepared, but leave the main cavity one-third if not one-half empty; no more is required than will fairly smooth out creases in the skin. Reduce bulk rather by flattening out than by general compression. Use tow instead of cotton; and if at all short of tow, economize with paper, hay, etc., at least for the deeper portions of the main stuffing. Large birds may be "set" in a great quantity of tow; wrapped in paper, much like any other parcel; or simply left to dry on the table, the wings being only supported by cushioning or other suitable means.

Shape. — Some special configurations have been noticed in the last paragraph, prematurely perhaps, but leading directly up to further considerations respecting *shape* of certain birds as a modifying element in the process of preparation. As for skinning, there is one extremely important matter. Most ducks, many woodpeckers, flamingoes, and doubtless some others with which I am not familiar, cannot be skinned in the usual way, because the head is too large for the calibre of the neck and cannot be drawn through. In such cases, skin as usual to the base of the skull, cut off the head there (inside the skin of course), and operate upon it, after turning the skin right side out, as follows: Part the feathers carefully in a straight line down the back of the skull, make a cut through the skin, just long enough to permit the head to pass, draw out the skull through this opening, and dress it as already directed. Return it, draw the edges of the cut nicely together, and sew up the opening with a great many fine stitches. Simple as it may appear, this process is often embarrassing, for the cut has an unhappy tendency to wander about the neck, enlarging itself even under the most careful manipulation; while the feathers of the parts are usually so short, that it is difficult to efface all traces of the operation. I consider it very disagreeable; but for ducks I know of no alternative. I have however found out a way to avoid it with woodpeckers, excepting the very largest; it is this: Before skinning, part the eyelids, and plunge the scalpel right into the eyeballs; seize the cut edge of the ball with the forceps, and pull the eye right out. It may be dexterously done without spilling the eye-water on the plumage; but, for fear of this, previously put a little pile of plaster on the spot. Throw arsenic into the socket, and then fill it with cotton poked in between the lids. The eyes are thus disposed of. Then, in skinning, when you come to the head, dissever it from the neck and work the skull as far out as you can; it may be sufficiently exposed, in all cases, for you to gouge out the base of the skull with the scissors, and get at the brain to remove it. Apply an extra large dose of arsenic, and you will never hear from what jaw-muscle has been left in. In all these cases, as already remarked, the head is preferably set lying on one side, with the bill pointing obliquely to the right or left. Certain birds require a special mode of *setting;* these are, birds with very long legs or neck, or both, as swans, geese, pelicans, cormorants, snakebirds, loons, and especially cranes, herons, ibises, and flamingoes. Long legs should be doubled completely on themselves by bending at the heel-joint, and either tucked under the wings, or laid on the under surface; the chief point is to see that the toes lie flat, so that the claws do not stick up, to catch in things or get broken off. A long neck should be carefully folded; not at a sharp angle with a crease in the skin, but with a short curve, and brought round either to the side of the bird or on its breast, as may seem most convenient. The object is to make a "bale" of the skin as nearly as may be, and when it is properly effected it is surprising what little space a crane, for instance, occupies. But it is rarely, if ever, admissible to bend a tail back on the body, however inconveniently long it may be. Special dilations of skin, like the pouch of a pelican, or the air sacs of a prairie hen, may be moderately displayed.

Thin Skin. — Loose Plumage. — It is astonishing how much resistance is offered by the thin skin of the smallest bird. Though no thicker than tissue paper, it is not very liable

to tear if deftly handled; yet a rent once started often enlarges to an embarrassing extent if the skin be stretched in the least. Accidental rents and enlargements of shot-holes should be neatly sewn up, if occurring in an exposed place; but in most cases the plumage may be set to hide the openings. The trogons are said to have remarkably thin and delicate skin; I have never handled one in the flesh. Among our birds, the cardinal grosbeak and the species of *Caprimulgidæ* have, I think, about the tenderest skins. The obvious indication in all such cases is simply a little extra delicacy of manipulation. In skinning most birds, you should not loose more than a feather or two, excepting those loosened by the shot. Pigeons are peculiar, among our birds, for the very loose insertion of their plumage; you will have to be particularly careful with them, and in spite of all your precautions a good many feathers will probably drop. As stripping down the secondary quills from the forearm, in the manner already indicated, will almost invariably set these feathers free from the skin, I recommend you not to attempt it, but to dress the wings as prescribed for large birds.

Fatness. — Fat is a substance abhorred of all dissectors; always in the way, embarrassing operations and obscuring observations; while it is seldom worth examination after its structure has once been ascertained. It is particularly obnoxious to the taxidermist, since it is liable to soil the plumage during skinning, and also to soak into the feathers afterwards; and greasy birdskins are never pleasing objects. A few birds never seem to have any fat; some, like petrels, are always oily; at times, especially in the indolent autumn season, when birds have little to do but feed, the great majority acquire an *embonpoint* doubtless to their own satisfaction, but to the taxidermist's discomfort. In all such cases gypsum should be lavishly employed. Strew plaster plentifully, from the first cut all through the operation; dip your fingers in it frequently, as well as your instruments. The invaluable absorbent will deal with most of the "running" fat. When the skin is completely reversed, remove as much of the solid fat as possible; it is generally found occupying the areolar tissue of particular definite tracts, and most of it may usually be peeled or flaked off in considerable masses. Since the soft and oozy state of most birds' fat at ordinary temperatures may be much improved by cold, it will repay you to leave your birds on ice for a while before skinning, if you have the means and time to do so; the fat will become quite firm. There is a device for preventing or at any rate lessening the soiling of the plumage so apt to occur along the line of your incision; it is invaluable in all cases of white plumage. Take a strip of cloth of greater width than the length of the feathers, long enough to go up one side of the cut and down the other. Sew this closely to the skin all around the cut, and it will form an apron to guard the plumage. You will too frequently find that a bird, prepared without soiling and laid away apparently safe, afterwards grows greasy; if the plumage is white, it soon becomes worse than ever by showing dust that the grease catches. Perhaps the majority of such birds in our museums show the dirty streak along the belly. The reason is, that the grease has oozed out along the cut, or wherever else the skin has been broken, and infiltrated the plumage, being drawn up apparently by capillary attraction, just as a lampwick "sucks up" oil. Sometimes, without obviously soiling the plumage, the grease will run along the thread that ties the label, and make a uniformly transparent piece of "oil-paper." I have no remedy to offer for this gradual infiltration of the plumage. It will not wash out, even with soap and water. Possibly careful and persistent treatment with an ether might be effective, but I am not prepared to say it would be. Removal of all fat that can be got off during skinning, with a liberal use of plaster, will in a measure prevent a difficulty that remains incurable.

Bloodstains, etc. — In the nature of the case, this complication is of continual occurrence; fortunately it is easier dealt with than greasiness. Much may be done in the field to prevent bloodying of the plumage, as already said. A little blood does not show much on a dark

plumage; but it is of course conspicuous on light or white feathers. Dried blood may often be scraped off, in imitation of the natural process by which a bird cleanses its plumage with the bill; or be pulverized by gently twiddling the feathers between the fingers, and then blown off. But feathers may by due care be *washed* almost as readily as clothing; and we must ordinarily resort to this to remove all traces of blood, especially from white surfaces. If properly dried they do not show the operation. With a soft rag or pledget of cotton dipped in warm water bathe the place assiduously, pressing down pretty hard, only taking care to stroke the feathers the right way, so as not to crumple them, until the red color disappears; then you have simply a wet place to deal with. Press gypsum on the spot; it will cake; flake it off and apply more, till it will no longer stick. Then raise the feathers on a knife-blade and sprinkle gypsum in among them; pat it down and shake it up, wrestling with the spot till the moisture is entirely absorbed. Two other fluids of the body will give you occasional annoyance, — the juices of the alimentary canal and the eye-water. Escape of the former by mouth, nostrils, or vent is preventable by plugging these orifices, and its occurrence is inexcusable. But shot often lacerates the gullet, crop, and bowels, and though nothing may flow at the time, subsequent jolting or pressure in the game-bag causes the escape of fluids: a seemingly safe specimen may be unwrapped to show the whole belly-plumage a sodden brown mass. Such accidents should be treated precisely like bloodstains; but it is to be remarked that these stains are not seldom indelible, traces usually persisting in white plumage at least in spite of our best endeavors. Eye-water, insignificant as it may appear, is often a great annoyance. This liquor is slightly glairy, or rather glassy, and puts a sort of sizing on the plumage difficult to efface; the more so since the soiling necessarily occurs in a conspicuous place, where the plumage is too scanty and delicate to bear much handling. It frequently happens that a lacerated eyeball, by the elasticity of the coats, or adhesion of the lids, retains its fluid till this is pressed out in manipulating the parts; and recollecting how the head lies buried in plumage at that stage of the process, it will be seen that not only the head, but much of the neck and even the breast may become wetted. If the parts are extensively soaked, the specimen is almost irreparably damaged, if not ruined. Plaster will absorb the moisture, but much of the sizing may be retained on the plumage; therefore, though the place seems simply wet, it should be thoroughly washed with water before the gypsum is applied. I always endeavor to prevent the accident; if I notice a lacerated eyeball, I extract it before skinning, in the manner described for woodpeckers. Miscellaneous stains, from the juices of plants, etc., may be received; all such are treated on general principles. Blood on the beak and feet of rapacious birds, mud on the bill and legs of waders, etc., etc., may be washed off without the slightest difficulty. A land bird that has fallen in the water should be recovered as soon as possible, picked up *by the bill*, and shaken; most of the water will run off, unless the plumage is completely soaked. It should be allowed to dry just as it is, without touching the plumage, before being wrapped and bagged. If a bird fall in soft mud, the dirt should be scraped or snapped off as far as this can be done without plastering the feathers down, and the rest allowed to dry; it may afterward be rubbed fine and dusted off, when no harm will ensue, except to white feathers which may require washing.

Mutilation. — You will often be troubled, early in your practice, with broken legs and wings, and various lacerations; but the injury must be very severe (such as the carrying away of a limb, or blowing off the whole top of a head) that cannot be in great measure remedied by care and skill. Suppose a little bird, shot through the neck or small of the back, comes apart while being skinned; you have only to remove the hinder portion, be that much or little, and go on with the rest as if it were the whole. If the leg bone of a small bird be broken near the heel, let it come away altogether; it will make little if any difference. In case of the same accident to a large bird that ought to have the legs wrapped, whittle out a peg and stick

it in the hollow stump of the bone; if there is no stump left, file a piece of stout wire to a point and stick it into the heel joint. If the forearm bone that you usually leave in a small bird is broken, remove it and leave the other in; if both are broken, do not clean the wings so thoroughly that they become detached; an extra pinch of arsenic will condone the omission. In a large bird, if both bones of the forearm are broken, splint them with a bit of wood laid in between, so that one end hitches at the elbow, the other at the wrist. A humerus may be replaced like a leg bone, but this is rarely required. If the skull be smashed, save the pieces, and leave them if you can; if not, imitate the arch of the head with a firm cotton-ball. A broken tarsus is readily splinted with a pin thrust up through the sole of the foot: if too large for this, use a pointed piece of wire. There is no mending a bill when part of it is shot away; for I think the replacing of part by putty, stucco, etc., inadmissible; but if it be only fractured, the pieces may usually be retained in place by winding with thread, or with a touch of glue or mucilage. It is singular, by the way, what unsightliness results from a very trifling injury to the bill; much, I suppose, as a boil on a person's nose is peculiarly deplorable. I have already hinted how artfully various weak places in a skin, due to mutilation or loss of plumage, may be hidden.

Decomposition. — It might seem unnecessary to speak of what may be *smelled out* so readily as animal putrescence; but there are some useful points to be learned in this connection, besides the important sanitary precautions that are to be deduced. Immediately after death the various fluids of the body begin to "settle" (so to speak), and shortly after the muscular system as a rule becomes fixed in what is technically called *rigor mortis*. This stiffening usually occurs as the animal heat dies away; but its onset, and especially its duration, is very variable, according to circumstances, such as cause of death; although in most cases of sudden violent death of an animal in previous good health, it seems to depend chiefly upon temperature, being transient and imperfect, or altogether wanting, in hot weather. As it passes off, the whole system relaxes, and the body soon becomes as "limp" as at the moment of death. This is the period immediately preceding decomposition; in fact, it may be considered as the stage of incipient putridity; it is very brief in warm weather, and it should be seized as the last opportunity of preparing a bird without inconvenience and even danger. If not skinned at once, putrescence becomes established; it is indicated by the effluvium (at the outset "sour," but rapidly acquiring a variety of disgusting odors); by the distension of the abdomen with gaseous products of decomposition; by the loosening of the cuticle, and consequently of the feathers; and by other signs. If you part the feathers of a bad-smelling bird's belly to find the skin swollen and livid or greenish, while the feathers come off at a touch, the bird is too far gone to be recovered without trouble and risk that no ordinary specimen warrants. It is a singular fact that this early putrescence is more poisonous than utter rottenness; as physicians are aware, a post-mortem examination at this stage, or even before it, involves more risk than their ordinary dissecting-room experience. It seems that both natural and pathological poisons lose their early virulence by resolution into other products of decay. The obvious deduction from all this is to skin your birds soon enough. Some say they are best skinned perfectly fresh, but I see no reason for this; when I have time to choose, I take the period of rigidity as being preferable on the whole; for the fluids have then "settled," and the limbs are readily relaxed by manipulation. If you have a large bag to dispose of, and are pressed for time, set them in the coolest place you can find, preferably on ice; a slight lowering of temperature may make a decided difference. Disembowelling, which may be accomplished in a moment, will materially retard decomposition. Injections of creosote or dilute carbolic acid will arrest decay for a time, for an indefinitely long period if a large quantity of these antiseptics be employed. When it becomes desirable (it can never be *necessary*) to skin a putrescent bird, great care must be exercised not only to accomplish the operation, but to avoid

danger. I must not, however, unconsciously lead you to exaggerate the risk, and will add that I think it often overrated. I have probably skinned birds as "gamey" as any one has, and repeatedly, without being conscious of any ill effects. I am sure that no poison, ordinarily generated by decomposition of a body *healthy* at death, can compare in virulence with that commonly resulting after death by many diseases. I also believe that the gaseous products, however offensive to the smell, are innocuous as a rule. The danger practically narrows down to the absorption of fluids through an abraded surface; the poison is rarely taken in by natural pores of healthy skin, if it remain in contact but a short time. Cuts and scratches may be closed with a film of collodion, or covered with isinglass or court plaster, or protected by rubber cots on the fingers. The hands should, of course, be washed with particular care immediately after the operation, and the nails scrupulously dressed. Having never been poisoned (to my knowledge), I cannot give the symptoms from personal experience; but I will quote from Mr. Maynard:

"In a few days numerous pimples, which are exceedingly painful, appear upon the skin of the face and other parts of the person and, upon those parts where there is chafing or rubbing, become large and deep sores. There is a general languor and, if badly poisoned, complete prostration results; the slightest scratch becomes a festering sore. Once poisoned in this manner (and I speak from experience), one is never afterward able to skin any animal that has become in the least putrid, without experiencing some of the symptoms above described. Even birds that you handled before with impunity, you cannot now skin without great care. The best remedy in this case is, as the Hibernian would say, not to get poisoned, ... bathe the parts frequently in cold water; and, if chafed, sprinkle the parts after bathing, with wheat flour. These remedies, if persisted in, will effect a cure, if not too bad; then, medical advice should be procured without delay."[1]

How to mount Birds. — As some may not improbably procure this volume with a reasonable expectation of being taught to *mount* birds, I append the required instructions, although the work only professes to treat of the preparation of skins for the cabinet. As a rule, the purposes of science are best subserved by *not* mounting specimens; for display, the only end attained, is not required. I would strongly advise you not to mount your rarer or otherwise particularly valuable specimens; select for this purpose nice, pretty birds of no special scientific value. The principal objections to mounted birds are, that they take up altogether too much room, require special arrangements for keeping and transportation, and cannot be handled for study with impunity. Some might suppose that a mounted bird would give a better idea of its figure and general aspect than a skin; but this is only true to a limited extent. Faultless mounting is an art really difficult, acquired by few; the average work done in this line shows something of caricature, ludicrous or repulsive, as the case may be. To copy nature faithfully by taxidermy requires not only long and close study, but an artistic sense; and this last is a rare gift. Unless you have at least the germs of the faculty in your composition, your taxidermal success will be incommensurate with the time and trouble you bestow. My own taxidermal art is of a low order, decidedly not above average; although I have mounted a great many birds that would compare very favorably with ordinary museum work, few of them have entirely answered my ideas. A live bird is to me such a beautiful object that the slightest taxidermal flaw in the effort to represent it is painfully offensive; perhaps this makes me place the standard of excellence too high for practical purposes. I like a good honest birdskin that does not pretend to be anything else; it is far preferable to the

[1] Avoid all mechanical irritation of the inflamed parts; touch the parts that have ulcerated with a stick of lunar caustic; take a dose of salts; use syrup of the iodide of iron, or tincture of the chloride of iron, say thirty drops of either, in a wineglass of water, thrice daily; rest at first, exercise gradually as you can bear it; and skin no birds till you have completely recovered.

ordinary taxidermal abortions of the show-cases. But if, after the warnings that I mean to convey in this paragraph, you still wish to try your hand in the higher department of taxidermy, I will explain the whole process as far as manipulation goes; the art you must discover in yourself.

The operation of skinning is precisely the same as that already given in detail; then, instead of stuffing the skin as directed above, to lie on its back in a drawer, you have to stuff it so that it will stand up on its feet and look as much like a live bird as possible. To this end a few additional implements and materials are required. These are: *a*, annealed wire of various numbers; it may be iron or brass, but must be perfectly annealed, so as to retain no elasticity or "spring;" *b*, several files of different sizes; *c*, some slender, straight, brad awls; *d*, cutting pliers; *e*, setting needles, merely sewing or darning needles stuck in a light wooden handle, for dressing individual feathers; *f*, plenty of pins (the long, slender insect pins used by entomologists are the best) and sewing thread; *g*, an assortment of glass eyes. (The fixtures and decorations are noticed, beyond, as occasion for their use arises.)

There are two principal methods of mounting, which may be respectively styled *soft* stuffing and *hard* stuffing. In the former, a wire framework, consisting of a single anterior piece passing in the middle line of the body up through the neck and out at top of the head, is immovably joined behind with two pieces, one passing through each leg; around this naked forked frame soft stuffing is introduced, bit by bit, till the proper contour of the skin is secured. I have seen very pretty work of this kind, particularly on small birds; but I consider it much more difficult to secure satisfactory results in this way than by hard stuffing, and I shall therefore confine attention to the latter. This method is applicable to all birds, is readily practised, facilitates setting of the wings, arranging of the plumage, and giving of any desired attitude. In hard stuffing, you make a firm ball of tow rolled upon a wire of the size and shape of the bird's body and neck together; you introduce this whole, afterwards running in the leg wires and clinching them immovably in the mass of tow.

Having your empty skin in good shape, as already described; cut three pieces of wire of the right[1] size; one piece somewhat longer than the whole bird, the other pieces two or three times as long as the whole leg of the bird. File one end of each piece to a fine sharp point; try to secure a three-edged cutting point like that of a surgical needle, rather than the smooth punching point of a sewing-needle, as the former perforates more readily. Have these wires perfectly straight.[2] Bend a small portion of the unfiled end of the longer wire irregularly upon itself, as a convenient nucleus for the ball of tow.[3] Take fine clean tow, in loose dossils, and wrap it round and round the wire nucleus, till you make a firm ball, of the size and shape of the bird's body and neck. Study the contour of the skinned body: notice the swelling breast-muscles, the arch of the lower back, the hollow between the furcula into which the neck, when naturally curved, sinks. Everything depends upon correct shaping of the artificial body; if it be misshapen, no art can properly adjust the skin over it. Firmness of the tow ball and accurate contour may both be secured by wrapping the mass with sewing thread, loosening here, tightening there, till the shape is satisfactory. Be particular to secure a *smooth* superficies; the skin in drying will shrink close to the stuffing, disclosing its irregularities, if there be any, by the maladjustment of the plumage that will ensue. Observe especially that the neck, though the direct continuation of the backbone, dips at its lower end into the hollow of the merry-thought, and so virtually begins there instead of directly between the shoulders.

[1] The right size is the smallest that will support the whole weight of the stuffing and skin without bending, when a piece is introduced into each leg. If using too thick wire, you may have trouble in thrusting it through the legs, or may burst the tarsal envelope.

[2] If accidentally kinky, the finer sizes of wire may be readily straightened by drawing strongly upon them so as to stretch them a little. Heavier wire must be hammered out straight.

[3] Cotton will not do at all; it is too soft and elastic, and moreover will not allow of the leg wires being thrust into it and there clinched.

The three mistakes most likely to be made by a beginner are, getting the body altogether too large, not firm enough, and irregular. When properly made, it will closely resemble the bird's body and neck, with an inch or several inches of sharp-pointed wire protruding from the anterior extremity of the neck of tow. You have now to introduce the whole affair into the skin. With the birdskin on its back, the tail pointing to your right elbow, and the abdominal opening as wide as possible, hold the tow body in position relative to the skin; enter the wire, pass it up through the neck, bring the sharp point exactly against the middle of the skull, pierce skull and skin, causing the wire to protrude some distance from the middle of the crown. Then by gentle means insinuate the body, partly pushing it in, partly drawing the skin over it, till it rests in its proper position. This is just like drawing on a tight kid glove, and no more difficult. See that the body is *completely* encased; you must be able to close the abdominal aperture entirely. You have next to wire the legs. Enter the sharp point of one of the leg-wires already prepared, exactly at the centre of the sole of the foot, thrusting it up inside the tarsal envelope the whole length of the "shank," thence across the heel joint [1] and up along the next bone of the leg, still inside the skin. The point of the wire will then be seen within the skin, and may be seized and drawn a little further through, and you will have passed a wire entirely out of sight all the way along the leg. The end of the wire is next to be fixed immovably in the tow ball. Thrust it in at the point where the knee, in life, rests against the side of the body.[2] Bring the point to view, bend it over and reinsert it till it sticks fast. There are no special directions to be given here; fasten the wire in any way that effectually prevents "wabbling." You may find it convenient to wire both legs before fastening either, and then clinch them by twisting the two ends together. But remember that the leg-wires may be fixed respecting each other, yet permit a see-saw motion of the body upon them. This must not be; the body and legs must be fixed upon a jointless frame. Having secured the legs, close the abdominal opening nicely, either by sewing or pinning; you may stick pins in anywhere, as freely as in a pin-cushion; the feathers hide their heads. Stick a pin through the pope's nose to fix the tail in place.

All this while the bird has been lying on its back, the neck stretched straight in continuation of the body, wired stiffly, the legs straddling wide apart, straight and stiff, the wings lying loosely, half-spread. Now bring the legs together, parallel with each other, and make the sharp bend at the heel joint that will bring the feet naturally under the belly (over it, as the bird lies on its back). Pick up the bird by the wires that project from the soles and set it on its stand, by running the wires through holes bored the proper distance apart, and then securing the ends by twisting. The temporary stand that you use for this purpose should have a heavy or otherwise firm support, so as not easily to overturn during the subsequent manipulations. At this stage the bird is a sorry-looking object; but if you have stuffed correctly and wired securely, it will soon improve. Begin by making it *stand* properly. The common fault here is placing the tarsi too nearly perpendicular. Perching birds, constituting the majority, habitually stand with the tarsi more nearly *horizontal* than perpendicular, and generally keep the tarsi parallel with each other. Wading and most walking birds stand with the legs more nearly upright and straight. Many swimming birds straddle a little; others rarely if ever. See that the toes clasp the perch naturally, or are properly spread on the flat surface. Cause the flank feathers to be correctly adjusted over the tibiæ (and here I will remark that with most birds little, if any, of the tibiæ shows in life), the heel joint barely, if at all, projecting

[1] There is occasionally difficulty in getting the wire across this joint, from the point sticking into the enlarged end of the shin-bone. In such case, take stout pliers and pinch the joint till the bone is smashed to fragments. The wire will then pass and the comminution will not show. If there is any trouble in passing the wire through the tarsus, bore a hole for it with a brad awl.

[2] This point is further forward and more belly-ward than you might suppose. Observe the skinned body again, and see where the lower end of the thigh lies. If you insert the wire too far back, you cannot by any possibility balance the bird naturally on its perch; it will look in imminent danger of toppling over.

from the general plumage. It is a common fault of stuffing not to draw the legs closely enough to the body. Above all, look out for the centre of gravity; though you have really fastened the bird to its perch, you must not let it look as if it would fall off if the wires slipped; it must appear to rest there of its own accord. Next, give the head and neck a preliminary setting, according to the attitude you have determined upon. This will bring the plumage about the shoulders in proper position for the setting of the wings, to which you may at once attend. If the body be correctly fashioned and the skin of the shoulders duly adjusted over it, the wings will fold into place without the slightest difficulty. All that I have said before about setting the wings in a skin applies here as well; but in this case they will not *stay* in place, since they fall by their own weight. They must be pinned up. Holding the wing in place, thrust a pin steadily through near the wrist joint, into the tow body. Sometimes another pin is required to support the weight of the primaries; it may be stuck into the flank of the bird, the outer quill feather resting directly upon it. With large birds a sharp pointed wire must replace the pin. When properly set, the wing-tips will fall together or symmetrically opposite each other, the quills and coverts will be smoothly imbricated, the scapular series of feathers will lie close, and no bare space will show in front of the shoulder. Much depends upon the *final* adjustment of the head. The commonest mistake is getting it too far away from the body. In the ordinary attitudes of most birds little neck shows, the head appearing nestled upon the shoulders. If the neck appears too long, it is not to be contracted by pushing the head directly down upon it, but by making an S curve of the neck. No precise directions can be given for the set of the head, but you may be assured it is a delicate, difficult matter; the slightest turn of the bill one way or another may alter the whole expression of the bird. You will of course have determined beforehand upon your attitude, upon what you wish the bird to appear to be doing; then, let your meaning be pointed by the bird's bill.

On the general subject of striking an attitude, and giving expression to a stuffed bird, little can be said to good purpose. If you are to become proficient in this art, it will come from your own study of birds in the field, your own good taste and appreciation of bird life. The manual processes are easily described and practised; it is easy to grind paint, I suppose, but not so to be an artist. I shall therefore only follow the above account of the general processes with some special practical points. After "attitudinizing" to your satisfaction, or to the best of your ability, the plumage is to be carefully "dressed." Feathers awry may be set in place with a light spring forceps, or needles fixed in a handle, one by one if necessary. When no individual feather seems out of place, it often occurs that the general plumage has a loose, slovenly aspect. This is readily corrected by wrapping with fine thread. Stick a pin into the middle of the back, another into the breast, and perhaps others, elsewhere. Fasten the end of a spool of sewing cotton to one of the pins, and carry it to another, winding the thread about among the pins, till the whole surface is covered with an irregular network. Tighten to reduce an undue prominence, loosen over a depression; but let the wrapping as a whole be light, firm, and even. This procedure, nicely executed, will give a smoothness to the plumage not otherwise attainable, and may be made to produce the most exquisite curves, particularly about the head, neck, and breast. The thread should be left on till the bird is perfectly dry; it may then be unwound or cut off, and the pins withdrawn. When a particular patch of skin is out of place, it may often be pulled into position and pinned there. You need not be afraid of sticking pins in anywhere: they may be buried in the plumage and left there, or withdrawn when the skin is dry. In addition to the main stuffing, a little is often required in particular places. As for the legs, they should be filled out in all such cases as I indicated earlier in this section; small birds require no such stuffing. It is necessary to fill out the eyes so that the lids rest naturally; it may be done as heretofore directed, or by putting in pledgets of cotton from the outside. A little nice stuffing is generally required about the upper throat. To stuff a bird with spread wings requires a special process, in most cases. The wings are to be wired,

exactly as directed for the legs: they may then be placed in any shape. But with most small birds, and those with short wings, simple pinning in the half-spread position indicating fluttering will suffice; it is readily accomplished with a long, slender insect pin. I have already spoken of fixing the tail by pinning or wiring the pope's nose to the tow body; it may be thus fixed at any desired elevation or depression. There are two ways of spreading the tail. One is to run a pointed wire through the quills, near their base, where the wire will be hidden by the coverts; each feather may be set at any required distance from the next by sliding it along this wire. This method is applicable to large birds; for small ones the tail may be fixed with the desired spread by enclosing it near its base in a split match, or two slips of card-board, with the ends tied together. This holds the feathers until they dry in position, when it is to be taken off. Crests may be raised, spread, and displayed on similar principles. A small crest, like that of a cardinal or cherry bird, for instance, may be held up till it dries in position by sticking in behind it a pin with a little ball of cotton on its head. It is sometimes necessary to make a bird's toes grasp a support by tying them down to it till they dry. The toes of waders that do not lie evenly on the surface of the stand may be tacked down with small brads. The bill may be pinned open or shut, as desired, by the method already given. Never paint or varnish a bird's bill or feet.

Substitution of an artificial eye for the natural one is essential for the good looks of a specimen. Glass eyes, of all sizes and colors, may be purchased at a moderate cost. The pupil is always black; the iris varies. You will, of course, secure the proper color if it is known, but if not, put in a dark brown or black eye. It is well understood that this means nothing; it is purely conventional. Yellow is probably the next most common color; then come red, white, blue, and green, perhaps approximately in this order of frequency. But do not use these striking colors at hap-hazard; sacrificing truth, perhaps, to looks. Eyes are generally inserted after the specimen is dry. Remove a portion of the cotton from the orbit, and moisten the lids till they are perfectly pliable: fix the eye in with putty or wet plaster of Paris, making sure that the lids are naturally adjusted over it. It goes in obliquely, like a button through a button-hole. Much art may be displayed in this little matter, making a bird look this way or that, to carry out the general "expression."

On finishing a specimen, set it away to dry: the time required varies, of course, with the weather, the size of the bird, its fatness, etc. The more slowly it dries the better; there is less risk of the skin shrinking irregularly. You will often find that a specimen set away with smooth plumage and satisfactory curves dries more or less out of shape, perhaps with the feathers raised in places. I know of no remedy: it may, in a measure, be prevented by scrupulous care in making the body smooth and firm, and in securing slow, equable drying. When perfectly dry remove the wrapping, pull out the superfluous pins or wires, nip off the others so short that the ends are concealed, and insert the eyes. The specimen is then ready to be transferred to its permanent stand.

Fixtures for the display of the object of course vary interminably. We will take the simplest case, of a large collection of mounted birds for public exhibition. In this instance, uniformity and simplicity are desiderata. "Spread eagle" styles of mounting, artificial rocks and flowers, etc., are entirely out of place in a collection of any scientific pretensions, or designed for popular instruction. Besides, they take up too much room. Artistic grouping of an extensive collection is usually out of the question: and when this is unattainable, half-way efforts in that direction should be abandoned in favor of severe simplicity. Birds look best on the whole in uniform rows, assorted according to size, as far as a natural classification allows. They are best set on the plainest stands, with circular base and a short cylindrical crossbar on a lightly turned upright. The stands should be painted dead-white, and be no larger than is necessary for secure support: a neat stiff paper label may be attached. A small collection of birds, as an ornament to a private residence, offers a different case: here, variety

of attitude and appropriate imitation of the birds' natural surroundings are to be secured. A miniature tree, on which a number of birds may be placed, is readily made. Take stout wire, and by bending it, and attaching other pieces, get the framework of the tree of the desired size, shape, and number of perches. Wrap it closely with tow to a proper calibre, remembering that the two forks of a stem must be together only about as large as the stem itself. Gather a basket full of lichens and tree moss; reduce them to coarse powder by rubbing with the hands; besmear the whole tree with mucilage or thin glue, and sift the lichen powder on it till the tow is completely hidden. This produces a very natural effect, which may be heightened by separately affixing larger scraps of lichen, or little bunches of moss; artificial leaves and flowers may be added at your taste. The groundwork may be similarly prepared with a bit of board, made adhesive and bestrewn with the same substance; grasses and moss may be added. If a flat surface is not desired, soak stout pasteboard till it can be moulded in various irregular elevations and depressions; lay it over the board and decorate it in the same way. Rocks may be thus nicely imitated, with the addition of powdered glass of various colors. Such a lot of birds is generally enclosed in a cylindrical glass case with arched top. As it stands on a table to be viewed from different points, it must be presentable on all sides. A niche in parlor or study is often fitted with a wall-case, which, when artistically arranged, has a very pleasing effect. As such cases may be of considerable size, there is opportunity for the display of great taste in grouping. A place is not to be found for a bird, but a bird for the place, — waders and swimmers below on the ground, perchers on projecting rests above. The surroundings may be prepared by the methods just indicated. One point deserves attention here; since the birds are only viewed from the front, they may have a "show-side" to which everything else may be sacrificed. Birds are represented flying in such cases more readily than under other circumstances, supported on a concealed wire inserted in the back of the case. I have seen some very successful attempts to represent a bird swimming, the duck being let down part way through an oval hole in a plate of thick glass, underneath which were fixed stuffed fishes, shells, and seaweed. It is hardly necessary to add that in all ornamental collections, labels or other scientific machinery must be rigorously suppressed.

Transportation of mounted birds offers obvious difficulty. Unless very small, they are best secured immovably inside a box by screwing the foot of the stands to the bottom and sides, so that they stay in place without touching each other. Or, they may be carefully packed in cotton, with or without removal of the stands. Their preservation from accidental injury depends upon the same care that is bestowed upon ordinary fragile ornaments of the parlor. The ravages of insects are to be prevented upon the principles to be hereafter given in treating of the preservation of birdskins.

§ 8. — MISCELLANEOUS PARTICULARS.

Determination of Sex. — This is an important matter, which must never be neglected. For although many birds show unequivocal sexual distinctions of size, shape, and color, like those of the barnyard cock and hen for instance, yet the outward characteristics are more frequently obscure, if not altogether inappreciable, on examination of the skin alone. Young birds, moreover, are usually indistinguishable as to sex, although the adults of the same species may be easily recognized. The rule results, that the sexual organs should be examined as the only infallible indices. The essential organs of masculinity are the *testicles;* similarly, the *ovaries* contain the essence of the female nature. However similar the accessory sexual structures may be, the testicles and ovaries are always distinct. The male organs of birds never leave the cavity of the belly to fill an external bag of skin (*scrotum*) as they do among mammalia; they remain within the abdomen, and lie in the same position as the ovaries of the female. Both these organs are situated in the belly opposite what corresponds to the

"small of the back," bound closely to the spine, resting on the front of the kidneys near their fore end. The testicles are a pair of subspherical or rather ellipsoidal bodies, usually of the same size, shape, and color, and are commonly of a dull opaque whitish tint. They always lie close together. A remarkable fact connected with them is, that they are not always of the same size in the same bird, being subject to periodical enlargement during the breeding season, and corresponding atrophy at other seasons. Thus the testicles of a house sparrow, no bigger than a pin's head in winter, swell to the size of peas in April. The ovary (for although this organ is paired originally, only one is usually functionally developed in birds) will be recognized as a flattish mass of irregular contour, and usually whitish color; when inactive, it simply appears of finely granular structure which may require a hand lens to be made out: when producing eggs, its appearance is unmistakable. Both testis and ovary may further be recognized by a thread leading to the end of the lower bowel, — in one case the sperm-duct, in the other the oviduct: the latter is usually much the more conspicuous, as it at times transmits the perfect egg. There is no difficulty in reaching the site of these organs. Lay the bird on the left side, its belly toward you: cut with the scissors through the belly-walls diagonally from anus to the root of the last rib, or further, snipping across a few of the lower ribs, if these continue far down, as they do in a loon for instance. Press the whole mass of intestines aside collectively, and you at once see to the small of the back. There you observe the kidneys, — large, lobular, dark reddish masses moulded into the concavity of the sacrum (or back middle bone of the pelvis): and on their surface, towards their fore end, lie testes or ovary, as just described. The only precaution required is, not to mistake for testicles a pair of small bodies capping the kidneys. These are the *adrenals* or "supra-renal capsules," — organs whose function is unknown, but with which at any rate we have nothing to do in this connection. They occur in both sexes, and if the testicles are not immediately seen, or the ovary not at once recognized, they might easily be mistaken for testicles. Observe, that instead of lying in front, they *cap* the kidneys; that they are usually yellowish instead of opaque whitish; and that they have not the firm, smooth, regular sphericity of the testicles. The testes, however, vary much in size and color than might be expected, being sometimes rather oblong or linear, and sometimes grayish or livid bluish, or reddish. There is occasionally but one. The sex determined, use the sign ♂ or ♀ to designate it, as already explained. In the very rare cases of impotence or sterility among birds, of course no organs will be observed: but I should dislike to become responsible for such labelling without very careful examination. The organs of a small bird out of the breeding season are never conspicuous, but may always be found on close scrutiny, unless the parts are disintegrated by a shot.

Recognition of Age is a matter of ornithological experience requiring in many or most cases great familiarity with birds for its even approximate accomplishment. There are, however, some unmistakable signs of immaturity, even after a bird has become full-feathered, that persist for at least one season. These are, in the first place, a peculiar soft fluffy "feel" of the plumage: the feathers lack a certain smoothness, density, and stiffening which they subsequently acquire. Secondly, the bill and feet are softer than those of the adults: the corners of the mouth are puffy and flabby, the edges and point of the bill are dull, and the scales, etc., of the legs are not sharply cut. Thirdly, the flesh itself is tender and pale colored. These are some of the points common to all birds, and are independent of the special markings that belong to the youth of particular species. Some birds are actually larger for a while after leaving the nest, than in after years when the frame seems to shrink somewhat in acquiring the compactness of senility. On the other hand, the various members, especially the bill and feet, are proportionally smaller at first. Newly growing quills are usually recognized on sight, the barrel being dark colored and full of liquid, while the vanes are incomplete. In studying, for example, the shape of a wing or tail, there is always reason to suspect that the natural

proportions are not yet presented, unless the quill is dry, colorless, and empty, or only occupied with shrunken white pith.

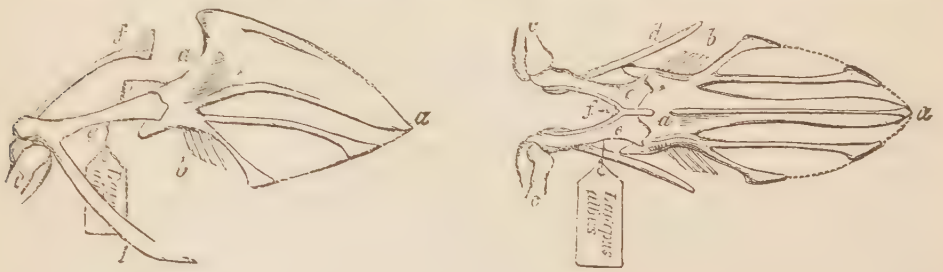
Examination of the Stomach frequently leads to interesting observations, and is always worth while. In the first place, we learn most unquestionably the nature of the bird's food, which is a highly important item in its natural history. Secondly, we often secure valuable specimens in other departments of zoölogy, particularly entomology. Birds consume incalculable numbers of insects, the harder kinds of which, such as beetles, are not seldom found intact in their stomachs; and a due percentage of these represent rare and curious species. The gizzards of birds of prey, in particular, should always be inspected, in search of the small mammals, etc., they devour; and even if the creatures are unfit for preservation, we at least learn of their occurrence, perhaps unknown before in a particular region. Mollusk-feeding and fish-eating birds yield their share of specimens. The alimentary canal is often the seat of parasites of various kinds, interesting to the helminthologist; other species are to be found under the skin, in the body of muscle, in the brain, etc. Most birds are also infested with external parasites of many kinds, so various that almost every leading species has its own sort of louse, tick, etc. Since these creatures are only at home with a *live* host, they will be found crawling on the surface of the plumage, preparing for departure, as soon as the body cools after death. There is thus much to learn of a bird aside from what the prepared specimen teaches, and moreover apart from regular anatomical investigations. Whenever practicable, brief items should be recorded on the label, as already mentioned.

Restoration of Poor Skins. — If your cabinet be a "general" one, comprising specimens from various sources, you will frequently happen to receive skins so badly prepared as to be unpleasant objects, besides failing to show their specific characters. There is of course no supplying of missing parts or plumage; but if the defect be simply deformity, this may usually be in a measure remedied. The point is simply to *relax* the skin, and then proceed as if it were freshly removed from the bird; it is what bird-stuffers constantly do in mounting birds from prepared skins. The relaxation is effected by moisture alone. Remove the stuffing; fill the interior with cotton or tow saturated with water, yet not dripping; put pads of the same under the wings; wrap the bill and feet, and set the specimen in a damp, cool place. Small birds soften very readily and completely; the process may be facilitated by persistent manipulation. This is the usual method, but there is another, more thorough and more effective; it is exposure to a vapor-bath. The appointments of the kitchen stove furnish all the apparatus required for an extempore "steamer;" the regular fixture is a tin vessel much like a wash-boiler, with closed lid, false bottom, and stopcock at lower edge. On the false bottom is placed a heavy layer of gypsum, completely saturated with water; the birds are laid on a perforated tray above it; and a gentle heat is maintained over a stove. The vapor penetrates every part of the skin, and completely relaxes it, without actually wetting the feathers. The time required varies greatly of course; observation is the best guide. The chief precaution is not to let the thing get too hot. Professor Baird has remarked that crumpled or bent feathers may have much of their original elasticity restored by dipping in hot water. Immersion for a few seconds suffices, when the feathers will be observed to straighten out. Shaking off superfluous water, they may be simply left to dry, or they may be dried with plaster. The method is chiefly applicable to the large feathers of the wings and tail. Soiled plumage of dried skins may be treated exactly as in the case of fresh skins.

Mummification. — As before mentioned, decay may be arrested by injections of carbolic acid and other antiseptics; if the tissues be sufficiently permeated with these substances, the body will keep indefinitely; it dries and hardens, becoming, in short, a "mummy." Injection

should be done by the mouth and vent, be thorough, and be repeated several times as the fluid dries in. It is an improvement on this to disembowel and fill the belly with saturated tow or cotton. Due care should be taken not to soil the feathers in any case, nor should the carbolic solution come in contact with the hands, for it is a powerful irritant poison. I mention the process chiefly to condemn it as an atrocious one; I cannot imagine what circumstances would recommend it, while only an extreme emergency could justify it. It is further objectionable because it appears to lend a dingy hue to some plumages, and to dull most of them perceptibly. Birds prepared — rather unprepared — in this way, may be relaxed by the method just described, and then skinned; but the operation is rather difficult.

Wet Preparations. — By this term is technically understood an object immersed in some preservative fluid. It is highly desirable to obtain more information of birds than their stuffed skins can ever furnish, and their structure cannot be always examined by dissection on the spot. In fact, a certain small proportion of the birds of any protracted or otherwise "heavy" collecting may be preferably and very profitably preserved in this way. Specimens in too poor plumage to be worth skinning may be thus utilized; so may the *bodies* of skinned birds, which, although necessarily defective, retain all the viscera, and also afford osteological material. Alcohol is the liquid usually employed, and, of all the various articles recommended, seems to answer best on the whole. I have used a very weak solution of chloride of zinc with excellent results; it should not be strong enough to show the slightest turbidity. As glass bottles are liable to break when travelling, do not fit corners, and offer practical annoyance about corkage, rectangular metal cans, preferably of copper, with screw-lid opening, are advisable. They are to be set in small, strong, wooden boxes, made to leave a little room for the lid wrench, muslin bags for doing up separate parcels, parchment for labels, etc. Unoccupied space in the cans should be filled with tow or a similar substance, to prevent the specimens from swashing about. Labelling should be on parchment; the writing should be perfectly dry before immersion; india-ink is the best. Skinned bodies should be numbered to correspond with the dried skin from which taken; otherwise they may not be identifiable. Large birds thrown in unskinned should have the belly opened, to let in the alcohol freely. Birds may be skinned, after being in alcohol, by simply drying them: they often make fair specimens. They are best withdrawn by the bill, that the "swash" of the alcohol at the moment of emersion may set the plumage all one way, and hung up to dry untouched. Watery moisture that may remain after evaporation of the alcohol may be dried with plaster.



FIGS 1, 2. — Views of sternum and pectoral arch of the ptarmigan, *Lagopus albus*, reduced; after A. Newton. 1, lateral view, with the bones upside down; 2, viewed from below. *a*, sternum or breast-bone, showing two long slender lateral processes; *b*, ends of sternal ribs; *c*, ends of humerus, or upper arm-bone, near the shoulder-joint; *d*, scapula, or shoulder-blade; *e*, coracoid; *f*, merry-thought, or furculum (clavicles).

Osteological and other Preparations (figs. 1–3 . — While complete skeletonizing of a bird is a special art of some difficulty, and one that does not fall within the scope of this treatise, I may mention two bony preparations very readily made, and susceptible of rendering

ornithology essential service. I refer to the skull, and to the breast-bone with its principal attachments. These parts of the skeleton are, as a rule, so highly characteristic that they afford in most cases invaluable zoölogical items. To save a skull is of course to sacrifice a skin, to all intents; but you often have mutilated or decayed specimens that are very profitably utilized in this way. The breast-bone (figs. 1, 2, *a*) excepting when mutilated, is always preservable with the skin, and for "choice" invoices may form its natural accompani- ment. You want to remove along with it the *coracoids* (the stout bones connecting the breast-bone with the shoulders, figs. 1, 2, *e*), the merry-thought (figs. 1, 2, *f*) intervening between these bones, and the shoulder-blades (figs. 1, 2, *d*), all without detachment from each other, for these bones collectively constitute the "shoulder- girdle," or *scapular arch*. Slice off the large breast muscles close to the bone, and divide their in- sertions into the wing-bones (*c*); scrape or cut away the muscles that tie the shoulder-blades to the chest; snip off the ribs (figs. 1, 2, *b*) close to the side of the breast- bone; sever a tough membrane usually found between the prongs of the wish-bone; then, by taking hold of the *shoulders* (figs. 1, 2, at *c*), you can lift out the whole affair, dividing some slight connec- tions underneath the bone and behind it. The following points require attention: the breast-bone often has long slender processes behind and on the sides (the com- mon fowl and the ptarmigan are extreme illustrations of this, as shown in the figures), liable to be cut by mistake for ribs, or to be snapped; the shoulder-blades usu- ally taper to a point, easily broken off; the merry-thought is some- times very delicate or defective. When travelling, it is generally advisable to make perfect prepara- tions of either skull or sternum; they are best dried with only super- fluous flesh removed, and besprin- kled with arsenic. The skull, if perfectly cleaned, is particularly liable to lose the odd-shaped, pronged bones that hinge the jaw, and the freely movable pair that push on the palate from behind. Great care should be exercised re- specting the identification of these bones, particularly the sternum, which should invariably bear the number of the specimen to which it belongs; the label should be tied to the coracoid bone. A skull is more likely to be able to speak for itself, and, besides, is not usu- ally accompanied by a skin; never- theless, any record tending to fa- cilitate its recognition should be duly entered on the register. There are methods, with which I am not familiar, of making elegant bony preparations. You may secure very good results by simply boil- ing the bones; or, what is perhaps better, macerating them in water till the flesh is completely rotted away, and then bleaching them in the sun. A little potassa or soda hastens the process. With breast- bones, if you can stop the process just when the flesh is completely dissolved but the tougher ligaments remain, you secure a "natural" preparation, as it is called; if the ligaments go too, the associate parts of a large specimen may be wired together, those of a small one glued. I think it best, with skulls, to clean them entirely of ligament as well as muscle; for the underneath parts are usually those conveying the most desirable information, and they should not be in the slightest degree obscured. Since in such

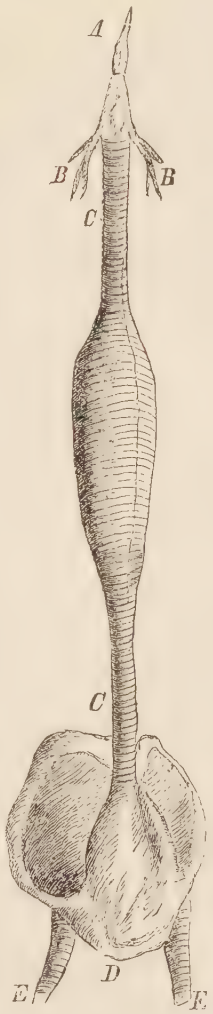


FIG. 3. — Trachea or windpipe of the male red-breasted merganser, *Mergus serrator*, about ½ nat. size, viewed from above (behind); after Newton, *A*, tongue; *B B*, its attachments; *C C*, windpipe, dilated in the middle and swelling below into a bony box, *D*; *E E*, bronchial tubes, going to lungs.

case the anvil-shaped bones, the palatal cylinders already mentioned, and sometimes other portions come apart, the whole are best kept in a suitable box. I prefer to see a skull with the sheath of the beak removed, though in some cases, particularly of hard-billed birds, it may profitably be left on. The completed preparations should be fully labelled by writing on the bone, in preference to an accompanying or attached paper slip, which *may* be lost. Some object to this, as others do to writing on eggs, that it "defaces" the specimen; but I confess I see in dry bones no beauty but that of utility.

"In many families of birds, as the ducks (*Anatidæ*), the *trachea* or windpipe of the male affords valuable means of distinguishing between the different natural groups, or even species, chiefly by the form of the bony labyrinth, or *bulla ossea*, situated at or just above the divarication of the bronchial tubes. A little trouble will enable the collector in all cases to preserve this organ perfectly, as represented in the annexed engraving (fig. 3). Before proceeding to skin the specimen, a narrow-bladed knife should be introduced into its mouth and by taking hold of the tongue (*A*) by the fingers or forceps, the muscles (*B B*) by which it is attached to the lower jaw should be severed as far as they can be reached, care being of course taken not to puncture the windpipe (*C C*); and later in the operation of skinning, when dividing the body from the neck or head, not to cut into or through it. This done, the windpipe can be easily withdrawn entire and separated from the neck, and then the sternal apparatus being removed as before described, its course must be traced to where, after branching off in a fork (*D*), the bronchial tubes (*E E*) join the lungs. At these latter points it is to be cut off. Then rinsing it in cold water, and leaving it to dry partially, it may, while yet pliant, be either wrapped round the sternum, or coiled up and labelled separately." — (*A. Newton.*)

§ 9. — COLLECTION OF NESTS AND EGGS.

Ornithology and Oölogy are twin studies, or rather one includes the other. A collection of nests and eggs is indispensable for any thorough study of birds; and many persons find peculiar pleasure in forming one. Some, however, shrink from "robbing birds' nests" as something particularly cruel; a sentiment springing, no doubt, from the sympathy and deference that the tender office of maternity inspires; but with all proper respect for the humane emotion, it may be said simply, that birds'-nesting is not nearly so cruel as bird-shooting. What I said in a former section, in endeavoring to guide search for birds, applies in substance to hunting for their nests; the essential difference is, that the latter are of course stationary objects, and consequently more liable to be overlooked, other things being equal, than birds themselves. Most birds nest on trees or bushes; many on the ground and on rocks; others in hollows. Some build elegant, elaborate structures, endlessly varied in details of form and material; others make no nest whatever. In this country, egging is chiefly practicable in May and during the summer; but some species, particularly birds of prey, begin to lay in January, while, on our southern border at least, the season of reproduction is protracted through September; so there is really a long period for search. Particular nests, of course, like the birds that build them, can only be found through ornithological knowledge; but general search is usually rewarded with a varied assortment. The best clew to a hidden nest is the actions of the parents; patient watchfulness is commonly successful in tracing the bird's home. As the science of oölogy has not progressed to the point of determining from the nests and eggs to what bird they belong, in even a majority of cases, the utmost care in authentication is indispensable. To be worth anything, not to be worse than worthless in fact, an egg must be identified beyond question; must be not only unsuspected, but above suspicion. A shade of suspicion is often attached to dealers' eggs; not necessarily implying bad faith or even negligence on the dealers' part, but from the nature of the case. It is often extremely difficult to make an unquestionable determination, as for

instance when numbers of birds of similar habits are breeding close together; or even impossible, as in case the parent eludes observation. Sometimes the most acute observer may be mistaken, circumstances appearing to prove a parentage when such is not the fact. It is in general advisable to secure the parent with the eggs: if shot or snared on the nest, the identification is simply unquestionable. If you do not yourself know the species, it then becomes *necessary* to secure the specimen, and retain it with the eggs. It is not required to make a perfect preparation; the head, or better, the head and a wing, will answer the purpose. When egging in downright earnest, a pair of climbing irons, a coil of $\frac{3}{8}$ inch rope, and a tin collecting box filled with cotton, become practically indispensable; these are the only field implements required in addition to those already specified.

Preparing Eggs. For blowing eggs, a set of special tools is needed. These are "egg-drills," — steel implements with a sharp-pointed conical head of rasping surface, and a slender shaft; several such, of different sizes, are needed; also, blow-pipes of different sizes, a delicate

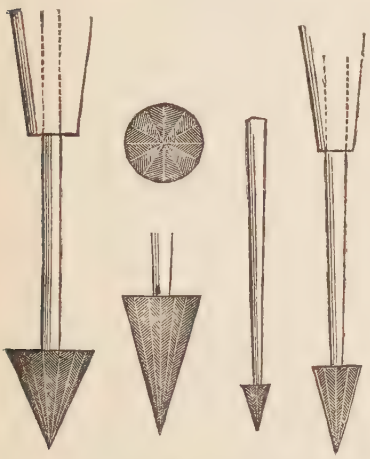


FIG. 4. — Egg-drills, different sizes, nat. size; after Newton.

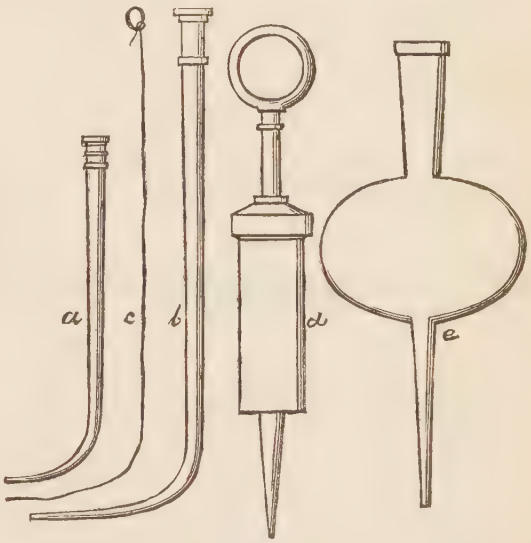


FIG. 5. — Instruments for blowing eggs; after Newton. *a*, *b*, blow-pipes, $\frac{1}{2}$ nat. size; *c*, wire for cleansing them; *d*, syringe, $\frac{1}{2}$ nat. size (the ring of the handle must be large enough to insert the thumb); *e*, bulbous insufflator, for sucking eggs.

thin pair of scissors, light spring forceps, some little hooks, and a small syringe. They are inexpensive, and may be had of any dealer in naturalists' supplies. (See figs. 4–7.) Eggs should never be blown in the old way of making a hole at each end; nor are two holes anywhere usually required. Opening should be effected on one side, preferably that showing least conspicuous or characteristic markings. If two are made, they should be rather near together; on the same side at any rate. But one is generally sufficient, as the fluid contents can escape around the blow-pipe. Holding the egg gently but steadily in the fingers,[1] apply the point of

[1] The usual method of emptying eggs through one small hole is doubtless supposed to be a very modern trick; but it dates back at least to 1828, when M. Danger proposed "a new method of preparing and preseving eggs for the cabinet," which is practically the one now followed, though he used a three-edged needle to prick the hole, instead of our modern drill, and did not appear to know some of our ways of managing the embryo. I make this reference to his article to call attention to one of the tools he recommends, which I think would prove useful, as being better than the fingers for holding an egg during drilling and blowing The simple instrument will be understood from a glance at the figure given in the Nuttall Bulletin, iii, 1878, p. 191. The oval rings are covered with light fabric, like mosquito-netting or muslin, and do not touch the egg, which is held lightly but securely in the netting. The cost would be trifling, and danger might be avoided by Danger's method

the drill perpendicularly to the surface, unless it be preferred to prick with a needle first. A twirling motion of the instrument gradually enlarges the opening by filing away the shell, and so bores a smooth-edged circular hole. This should be no larger than is required to insert the blow-pipe loosely, with room for the contents to escape around it. Nor is it always necessary to *insert* the pipe; a fine stream of water may be easily injected by holding the instrument close to the egg, but not quite touching. The blowing should be continuous and equable, rather than forcible; a strong puff easily bursts a delicate egg. Be sure that all the contents are removed; then rinse the interior thoroughly with clean water, either by taking a mouthful and sending it through a blow-pipe, or with the syringe. Blowing eggs is a rather fatiguing process, more so than it might seem; the cheek muscles soon tire, and the operator actually becomes "blown" himself before long. The operation had better be done over a basin of water, both to receive the contents, and to catch the egg if it slip from the fingers. The membrane lining the shell should be removed if possible. It may be seized by the edge around the hole, with the forceps, and drawn out, or picked out with a bent pin. But this is scarcely to be accomplished in the case of fresh eggs, when the membrane may be simply pared smoothly around the edge of the hole. Eggs that have been incubated of course offer difficulty, in proportion to the size of the embryo. The hole may be drilled, as before, but it must be larger; and as the drill is apt to split a shell after it has bored beyond a certain size of hole, it is often well to prick, with a fine needle, a circular series of minute holes almost touching, and then remove the enclosed circle of shell. This must be very carefully done, or the needle will indent or crack the shell, which, it must be remembered, grows more brittle towards the time of hatching. Well-formed embryos cannot be got bodily through any *hole* that can be made in an egg; they must be extracted piecemeal. They may be cut to pieces with the slender scissors introduced through the hole, and the fragments be picked out with the forceps, hooked out, or blown out. No embryo should be forced through a hole too small; there is every probability that the shell will burst at the critical moment. Addled eggs, the contents of which are thickened or hardened, offer some difficulty, to overcome which persistent syringing and repeated rinsing are required; or it may be necessary to fill them with water, and set them away for such length of time that the contents dissolve by maceration; carbonate of soda is said to hasten the solution; the process may be repeated as often as may be necessary. In no event must any of the animal contents be suffered to remain in the shell. When emptied

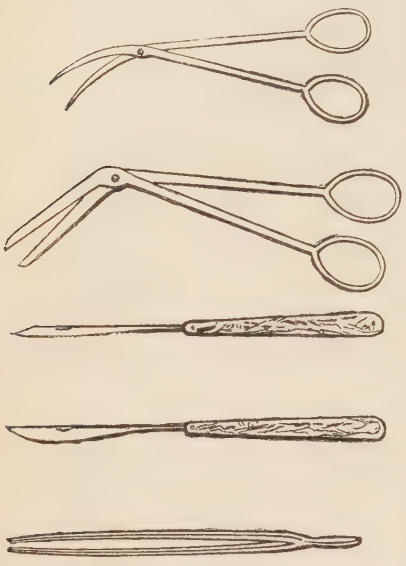


FIG. 6. — Scissors, knives, and forceps, ½ nat. size; after Newton.

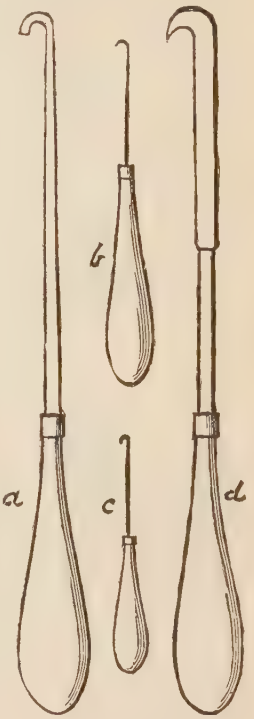


FIG. 7. — Hooks for extracting embryos, nat. size; after Newton. *a*, *b*, *c*, plain hooks; *d*, bill-hook, having cutting edge along the concavity.

and rinsed, eggs should be gently wiped dry, and set hole downward on blotting-paper to drain.[1] Broken eggs may be neatly mended, sometimes with a film of collodion, or a bit of tissue paper and paste, or the edges may be simply stuck together with any adhesive substance. Even when fragmentary a rare egg is worth preserving. Eggs should ordinarily be left empty; indeed, the only case in which any filling is admissible is that of a defective specimen to which some slight solidity can be imparted with cotton. It is unnecessary even to close up the hole. It is best, on all accounts, to keep eggs in *sets*, a "set" being the natural clutch, or whatever less number was taken from a nest. The most scrupulous attention must be paid to accurate, complete, and permanent labelling. So important is this, that the undeniable defacing of a specimen, by writing on it, is no offset to the advantages accruing from such fixity of record. It is practically impossible to attach a label, as is done with a bird-skin, and a loose label is always in danger of being lost or displaced. Write on the shell, then, as many items as possible; if done neatly, on the side in which the hole was bored, at least one good "show side" remains. An egg should always bear the same number as the parent, in the collector's record. In a general collection, where separate ornithological and oölogical registers are kept, identification of egg with parent is nevertheless readily secured, by making one the numerator the other the denominator of a fraction, to be simply inverted in its respective application. Thus, bird No. 456, and egg No. 123, are identified by making the former $\frac{4}{1}\frac{5}{2}\frac{6}{3}$ the latter $\frac{1}{4}\frac{2}{5}\frac{3}{6}$. All the eggs of a clutch should have the same number. If the shell be large enough, the name of the species should be written on it; if too small, it should be accompanied by a label, and may have the name indicated by a number referring to a certain catalogue. According to my "Check List," for example, "No. 1" would indicate *Turdus migratorius*. The date of collection is a highly desirable item; it may be abbreviated thus; 3 | 6 | 82 means June 3, 1882. It is well to have the egg authenticated by the collector's initials at least. Since "sets" of eggs may be broken up for distributions to other cabinets, yet permanent indication of the size of the clutch be wanted, it is well to have some method. A good one is to write the number of the clutch on each egg composing it, giving each egg of the set, moreover, its individual number. Supposing for example the clutch No. $\frac{1}{4}\frac{2}{5}\frac{3}{6}$ contained five eggs; one of them would be $\frac{1}{4}\frac{2}{5}\frac{3}{6}$ | 5 | 1: the next $\frac{1}{4}\frac{2}{5}\frac{3}{6}$. 5 . 2, and so on. But it should be remembered that all such arbitrary memoranda must be systematic, and be accompanied by a key. Eggs may be kept in cabinets of shallow drawers in little pasteboard trays, each holding a set, and containing a paper label on which various items that cannot be traced on the shell are written in full.

[1] *Reinforcing the Eggshell before Blowing.* — Fig. 8 "shows a piece of paper, a number of which, when gummed on to an egg, one over the other, *and left to dry*, strengthen the shell in such a manner that the instruments above described can be introduced through the aperture in the middle and worked to the best advantage, and thus a fully formed embryo may be cut up, and the pieces extracted through a very moderately sized hole; the number of thicknesses required depends, of course, greatly upon the size of the egg, the length of time it has been incubated, and the stoutness of the shell and the paper. Five or six is the least number that it is safe to use. Each piece should be left to dry before the next is gummed on. The slits in the margin cause them to set pretty smoothly, which will be found very desirable; the aperture in the middle of each may be cut out first, or the whole series of layers may be drilled through when the hole is made in the egg. For convenience' sake, the papers may be prepared already gummed, and moistened when put on (in the same way that adhesive postage labels are used). Doubtless, patches of linen or cotton cloth would answer equally well. When the operation is over, a slight application of water (especially if warm) through the syringe will loosen them so that they can be easily removed, and they can be separated from one another, and dried to serve another time. The size represented in the sketch is that suitable for an egg of moderate dimension, such as that of a common fowl. The most effectual way of adopting this method of emptying eggs is by using *very many layers of thin paper and plenty of thick gum*, but this is, of course, the most tedious. Nevertheless, it is quite worth the trouble in the case of really rare specimens, and they will be none the worse for operating upon from the delay of a few days caused by waiting for the gum to dry and harden. The naturalist to whom this method first occurred has found it answer remarkably well in every case that it has been used, from the egg of an eagle to that of a humming-bird, and among English oölogists it has been generally adopted." (*A. Newton*, in Smiths. Misc. Coll. 139. 1860.)

FIG. 8. — Nat. size.

Such trays should all be of the same depth, — half an inch is a convenient depth for general purposes; and of assorted sizes, say from one inch by one and one half inches up to three by six inches; it is convenient to have the dimensions regularly graduated by a constant factor of, say half an inch, so that the little boxes may be set side by side, either lengthwise or crosswise, without interference. Eggs may also be kept safely, advantageously, and with attractive effect, in the nests themselves, in which a fluff of cotton may be placed to steady them. When not too bulky, too loosely constructed, or of material unsuitable for preservation, nests should always be collected.[1] Those that are very closely attached to twigs should not be torn off. Nests threatening to come to pieces, or too frail to be handled without injury, may be secured by sewing through and through with fine thread: indeed, this is an advisable precaution in most cases. Packing eggs for transportation requires much care, but the precautions to be taken are obvious. I will only remark that there is no safer way than to leave them in their own nests, each wrapped in cotton, with which the whole cavity is to be lightly filled; the nests themselves being packed close enough to be perfectly steady.

§ 10. — CARE OF A COLLECTION.

Well Preserved Specimens will last "forever and a day," so far as natural decay is concerned. I have handled birds in good state, shot back in the twenties, and have no doubt that some eighteenth century preparations are still extant. The precautions against defilement, mutilation, or other mechanical injury, are self-evident, and may be dismissed with the remark, that *white* plumages, especially if at all greasy, require the most care to guard against soiling. We have, however, to fight for our possessions against a host of enemies, individually despicable but collectively formidable, — foes so determined that untiring vigilance is required to ward off their attacks even temporarily, whilst in the end they prove invincible. It may be said that to be eaten up by insects is the natural end of all bird-skins not sooner destroyed.

[1] "*A Plea for the Study of Nests*," made by Mr. Ernest Ingersoll in his excellent "Birds'-Nesting," suits me so well that I will transcribe it. "Whether or not it is worth while to collect nests — for there are many persons who never do so — is, it seems to me, only a question of room in the cabinet. As a scientific study there is far more advantage to be obtained from a series of nests than from a series of eggs. The nest is something with which the will and energies of the bird are concerned. It expresses the character of the workman; is to a certain extent an index of its rank among birds, — for in general those of the highest organization are the best architects, — and give us a glimpse of the bird's mind and power to understand and adapt itself to changed conditions of life. Over the shape and ornamentation of an egg the bird has no control, being no more able to govern the matter than it can the growth of its beak. There is as much difference to me, in the interest inspired, between the nest and the egg of a bird, as between its brain and its skull, — using the word brain to mean the seat of intellect. The nest is always more or less the result of conscious planning and intelligent work, even though it does follow a hereditary habit in its style; while the egg is an automatic production varying, if at all, only as the whole organization of the bird undergoes change. Don't neglect the nests then. In them more than anywhere else lies the key to the mind and thoughts of a bird, — the spirit which inhabits that beautiful frame and bubbles out of that golden mouth. And is it not this inner life, — this human significance in bird nature, — this *soul* of ornithology, that we are all aiming to discover? Nests are beautiful, too. What can surpass the delicacy of the humming-bird's home glued to the surface of a mossy branch or nestling in the warped point of a pendent leaf; the vireo's silken hammock; the oriole's gracefully swaying purse; the blackbird's model basket in the flags; the snug little caves of the marsh wrens; the hermitage-huts of the shy wagtails and ground-warblers, the stout fortresses of the sociable swallows! Moreover, there is much that is highly interesting which remains to be learned about nests, and which can only be known by paying close attention to these artistic masterpieces of animal art. We want to know by what sort of skill the many nests are woven together that we find it so hard even to disentangle; we want to know how long they are in being built; whether there is any particular choice in respect to location; whether it be a rule, as is supposed, that the female bird is the architect, to the exclusion of her mate's efforts further than his supplying a part of the materials. Many such points remain to be cleared up. Then there is the question of variation, and its extent in the architect of the same species in different quarters of its ranging area. How far is this carried, and how many varieties can be recorded from a single district, where the same list of materials is open to all the birds equally? Variation shows individual opinion or taste among the builders as to the suitability of this or that sort of timber or furniture for their dwellings, and observations upon it thus increase our acquaintance with the scope of ideas and habits characteristic of each species of bird."

Insect Pests (Figs. 9, 10, 11, 12) with which we have to contend belong principally to the two families *Tineidæ* and *Dermestidæ* — the former are moths, the latter beetles. The moths are of species identical with, and allied to, the common clothes moth, *Tinea flavifrontella*, the carpet moth, *T. tapetzella*, etc., — small species observed flying about our apartments and museums, in May and during the summer. The beetles are several rather small thick-set species, principally of the genera *Dermestes* and *Anthrenus*. I am able to figure species of these genera, with their larval stages, and of two other genera, *Ptinus* and *Sitodrepa*, through the attentions of Prof. C. V. Riley, the eminent entomologist. The larvæ ("caterpillars" of the moths, and "grubs" of the beetles) appear to be the chief agents of the destruction. The presence of the mature insects is usually readily detected; on disturbing an infested suite of specimens the moths

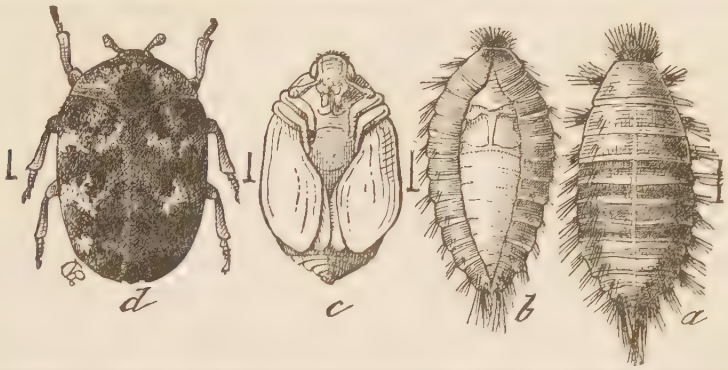


FIG. 9. — *Anthrenus scrofulariæ*, enlarged; the short line shows nat. size. *a*, *b*, larvæ; *c*, pupa; *d*, imago.

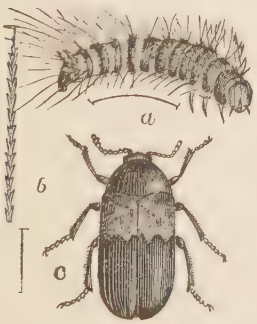


FIG. 10. — *Dermestes lardarius*, enlarged. *a*, larva; *b*, an enlarged hair; *c*, imago.

FIG. 11. — *Sitodrepa panicea*, enlarged. *a*, imago; *b*, its antenna, more enlarged.

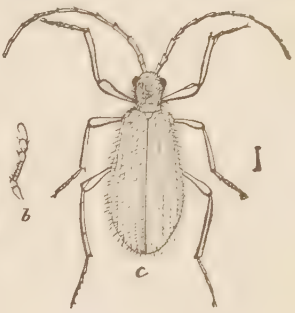


FIG. 12. — *Ptinus brunneus*.

flutter about, and the beetles crawl as fast as they can into shelter, or simulate death. The insidious larvæ, however, are not so easily observed, burrowing as they do among the feathers, or in the interior of a skin; whilst the minute eggs are commonly altogether overlooked. But the "bugs" are not long at work without leaving their unmistakable traces. Shreds of feathers float off when a specimen is handled, or fly out on flipping the skin with the fingers, and in bad cases even whole bundles of plumes come away at a touch. Sometimes, leaving the plumage intact, bugs eat away the horny covering of the bill and feet, making a peculiarly unhappy and irreparable mutilation. I suppose this piece of work is done by a particular insect, but if so I do not know what one. It would appear that when the bugs effect lodgment in any one skin, they usually finish it before attacking another, unless they are in great force. We may consequently, by prompt removal of an infested specimen, save further depredations;

nevertheless, the rest become "suspicious," and the whole drawer or box should be quarantined, if not submitted to any of the processes described beyond. Our lines of defence are several. We may mechanically oppose entrance of the enemy; we may meet him with abhorrent odors that drive him off, sicken or kill him, and finally we may cook him to death. I will notice these methods successively, taking occasion to describe a *cabinet* under head of the first.

Cases for Storage or Transportation should be rather small, for several reasons. They are easier to handle and pack. There are fewer birds pressing each other. Particular specimens are more readily reached. Bugs must effect just so many more separate entrances to infest the whole. Small lids are more readily fitted tight. For the ordinary run of small birds I should not desire a box over 18×18×18, and should prefer a smaller one; for large birds, a box just long enough for the biggest specimen, and of other proportions to correspond fairly, is most eligible. Whatever the dimensions, a proper box presupposes perfect jointing; but if any suspicion be entertained on this score, stout paper should be pasted along all the edges, both inside and out. We have practically to do with the lid only. If the lot is likely to remain long untouched, the cover may be screwed very close and the crack pasted like the others. Under other and usual circumstances the lid may be provided with a metal boss fitting a groove lined with india rubber or filled with wax. An excellent case may be made of tin with the lid secured in this manner, and further fortified with a wooden casing. Birdskins entirely free from insects or their eggs, encased in some such secure manner, will remain intact indefinitely; but there is misery in store if any bugs or nits be put away with them.

Cabinets. — As a matter of fact, most collections are kept readily accessible for examination, display, or other immediate use, and this precludes any disposition of them in "hermetical" cases. The most we can do is to secure tight fitting of movable woodwork. The "cabinet" is most eligible for private collections. This is, in effect, simply a bureau, or chest of drawers, protected with folding doors, or a front that may be detached, either of plain wood or sashing for panes of glass. It is simply astonishing how many birdskins of average size can be accommodated in a cabinet that makes no inconvenient piece of furniture for an ordinary room. A cabinet may of course be of any desired size, shape, and style. In general it will be better to put money into excellence of fitting rather than elegance of finish; the handsomest front does not compensate for a crack in the back or for a drawer that hitches. There should not be the slightest flaw in the exterior, and doors should fit so tightly that a puff of air may be felt on closing them. The greatest desideratum of the interior work, next after close fitting yet smooth running of the drawers, is economy of space. This is secured by making the drawers as thin as is consistent with stability; by having them slide by a boss at each end fitting a groove in the side wall, instead of resting on horizontal partitions; and by hinged countersunk handles instead of knobs. I do not recommend, except for a suite of the smallest birds, a multiplicity of shallow drawers, accommodating each one layer of specimens; it is better to have fewer deeper drawers, into which light shallow movable trays are fitted. These trays never need be of stuff over one-eighth or one-fourth of an inch thick, and may have bottoms of stiff pasteboard glued or tacked on. They may vary from one-half inch to two inches in depth, but this dimension should always be some factor of the depth of the drawer, so that a certain number of trays may exactly fill it. They should be just as long as one transverse dimension of the drawer, and rather narrow, so that two or more are set side by side. Finally, though they may be of different depths, they should be of the same length and breadth, so as to be interchangeable. They may simply rest on top of each other, or slide on separate projections inside the drawer. Such trays are extremely handy for holding particular sets of specimens, to be carried to the study table without disturbing the rest of the collection.

If a collection be so extensive that any particular specimen may not be readily hunted up,

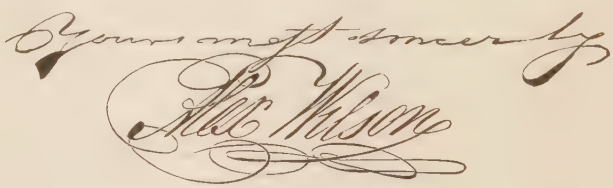
it will be found convenient to have the drawers themselves labelled with the name of the group within. A collection should always be methodically arranged — preferably according to some approved or supposed natural classification of birds; this is also the readiest mode, since, with some conspicuous exceptions, birds of the same natural group are approximately of the same *size*. If I were desired to suggest proportions for a private cabinet of most general eligibility, I should say four feet high, by three feet wide, by two feet deep, in the clear; this makes a portly yet not unwieldy looking object. It is wide enough for folding-doors, to be secured by bolts at top and bottom, and lock; not so high that the top drawer is not readily inspected; and of proportionate depth. Such a case will take seven drawers six inches deep either of the full width, or in two series with a median partition; these drawers will hold anything up to an eagle or crane. A part of them at least should have a full complement of such trays as I have described, — say three or four tiers of the shallower trays, three trays to a tier, each about two feet long by about a foot wide; and one or two tiers of deeper trays.

To Destroy Bugs. — In our present case prevention is not the best remedy, simply because it is not always practicable; in spite of all mechanical precautions the bugs will get in. We have, therefore, to see what will destroy them, or at least stop their ravages. It is a general rule that any pungent aromatic odor is obnoxious to them, and that any very light powdery substance restrains their movements by getting into the joints and breathing pores. Both these qualities are secured in the ordinary "insect powder," to be had of any leading druggist. It should be lavishly strewn on and among the skins, and laid in the corners of the drawers and trays. Thus employed it proves highly effective, and is on the whole the most eligible substance to use when a collection is constantly handled. Camphor is a valuable agent. Small fragments may be strewn about the drawers, or a lump pinned in mosquito netting in a corner. Benzine is also very useful. A small saucer full may be kept evaporating, or the liquid may be sprinkled — even poured — directly over the skins; it is very volatile and leaves little or no stain. It is, however, obviously ineligible when a collection is in constant use. My friend Mr. Allen informs me he has used sulphide of carbon with great success. The objection to this agent is, that it is a stinking poison; should be used in the open air, to escape the ineffably disgusting and deleterious odors, and its employ is properly restricted to cases for storage. When the bill or feet show they are attacked, further depredation may be prevented by pencilling with a strong solution of corrosive sublimate; a weaker solution, one that leaves no white film, on drying, on a black feather, may even be brushed over the whole plumage. Mr. Ridgway tells me that oil of bitter almonds is equally efficacious. But remember that these poisons must be used with care. Specimens may be buried in coarse refuse tobacco leaves. One or another of these lines of defence will commonly prove successful in destroying or driving off mature insects, and even in stopping the ravages of the larvæ; but I doubt that any such means will kill the "nits." With these we must deal otherwise; and their destruction no less that that of their parents is assured, if we subject them to a high temperature. Baking bird-skins is really the only process that can make us feel perfectly safe. Infected specimens, along with suspected ones, should be subjected to a dry heat, from 212° F. up to any degree short of singeing the plumage. This is readily done by putting the birds in a wooden tray in any oven — they must however be watched, unless you have special contrivances for regulating the temperature. How long a time is required is probably not ascertained with precision; it will be well to bake for several hours. When the beetles and larvæ are found completely parched, it may be confidently believed that the unseen eggs are out of the hatching way forever.

Two Items. — One is, that arsenic helps to keep out the bugs, besides preventing decay — a fact that should never be forgotten, and that should give sharper edge to my advice

respecting lavish use of the substance at the outset. If it be true, as some state, that bugs can eat arsenic without dying, it is also true that they do not relish it; and in entering a case of skins they will burrow by preference in those holding the least of it. This fact is continually exhibited in large collections, where if two birds be side by side, one being duly arsenicized and the other not so, one will be taken and the other left. My second item, with its proper deduction, will form, I think, a fitting conclusion to this treatise. It is a fact in the natural history of these our pests, that they are fond of peace and quiet, — they do not like to be disturbed at their meals. So they rarely effect permanent lodgment in a collection that is constantly handled, though the doors stand open for hours daily. As a consequence, the degree of our diligence in *studying* birdskins is likely to become the measure of our success in preserving them. I once read a work, by an eminent and learned divine, on the "Moral Uses of Dark Things," under which head the author included everything from earthquakes to mosquitoes. If there be a moral use in the "dark thing" that museum pests certainly are to us, we have it here. The very bugs urge on our work.

Fig. 13. — WILSON'S SCHOOL-HOUSE, NEAR GRAY'S FERRY, PHILADELPHIA From a drawing by M. S. Weaver, Oct. 22, 1841, received by Elliott Coues, February, 1879, from Malvina Lawson, daughter of Alexander Lawson, Wilson's engraver. See article in the "Penn Monthly," June, 1879, p. 443. The drawing was first engraved on wood, and published, by Thomas Meehan, in the "Gardener's Monthly," August, 1880, p. 248. The present impression is from an electrotype of that wood-cut. The size of the original is 5.10 × 3.95 inches. This reminder of early days of "Field Ornithology" in America may be further attested by the signature of



Part II.

GENERAL ORNITHOLOGY:

AN OUTLINE OF THE

STRUCTURE AND CLASSIFICATION OF BIRDS.

§ 1. — DEFINITION OF BIRDS.

GENERAL ORNITHOLOGY, like Field Ornithology, is a subject with which the student must have some acquaintance, if he would hope to derive either pleasure or profit from the Birds of North America. For any intelligent understanding of this subject, he must become reasonably familiar with the technical terms used in describing and classifying birds, and learn at least enough of the structure of these creatures to appreciate the characters upon which all description and classification is based. Extensive and varied and accurate as may be his random perception of objects of natural history, his knowledge is not scientific, but only empirical, until reflection comes to aid observation, and conceptions of the significance of what he knows are formed by logical processes in the mind. For

Science (Lat. *scire*, to know) is knowledge set in order; knowledge disposed after the rational method that best shows, or tends to show best, the true relations of observed facts. Sound scientific facts are the natural basis of all philosophic truth, and the safest stepping-stones to religious faith, — to that wisdom which comes only of knowing the relation which material entities bear to spiritual realities. The orderly knowledge of any particular class of facts — the methodical disposition of observations upon any particular set of objects — constitutes a Special Science. Thus

Ornithology (Gr. *ὄρνιθος, ornithos*, of a bird; *λόγος, logos*, a discourse) is the Science of Birds. Ornithology consists in the rational arrangement and exposition of all that is known of birds, and the logical inference of much that is not known. Ornithology treats of the physical structure, physiological processes, and mental attributes of birds; of their habits and manners; of their geographical distribution and geological succession; of their probable ancestry; of their every relation to one another and to all other animals, including man, — in short, of their significance in Nature and Supernature. The first business of Ornithology is to define its ground — to answer the question,

What is a Bird? — There is every reason to believe that a Bird is a greatly modified Reptile, being the offspring by direct descent of some reptilian progenitor; and there is no reason to suppose that any bird ever had any other origin than by due process of hatching out of an egg laid by its mother after fecundation by its father, — just what we believe to have been the invariable method during the period of the world known to human history. There is no reason to believe that any bird was ever originally created and endowed with the characters it now possesses; but that every bird now living is the naturally modified lineal descendant of parents that were less and less like itself, and more and more like certain reptiles, the further removed they were in the line of avian ancestry from such birds as are now living. This is the Darwinian logic of observed facts, upon which the modern Theory of Evolution is based, in opposition to the tradition of the special creation of every species of animal; which latter has no scientific basis whatever, and is consequently accepted as true by few thoughtful persons who are capable of forming independent judgments. Accordingly,

Birds and Reptiles — even those of the present geologic epoch — share so many and so important structural characters, that the chiefs of science of our day are wont to unite the two classes, *Aves* and *Reptilia*, in one primary group of the *Vertebrata*, or animals with a backbone. This group is called *Sauropsida*, or reptiliform; it is contrasted, on the one hand, with *Ichthyopsida*, or fish-like vertebrates, including Batrachians as well as Fishes; and, on the other, with *Mammalia*, the province of the Vertebrata which includes Man and all other animals that suckle their young. We find that

The Sauropsida (Gr. σαῦρος, *sauros*, a reptile; ὄψις, *opsis*, appearance), or lizard-like Vertebrates, agree with one another, and differ from other animals, in the following important combination of characters, substantially as laid down by Professor Huxley, — some of the characters being shared by the *Ichthyopsida*, and some by the *Mammalia*, but the sum of the characters being distinctive of *Sauropsida:* They are all oviparous (laying eggs hatched outside the body of the parent), or ovoviviparous (laying eggs hatched inside the body of the parent), being never viviparous (bringing forth alive young nourished before birth by the blood of the mother). The embryo develops those fœtal organs called *amnion* and *allantois*, and is nourished before hatching by the great quantity of yolk in the egg. There are no mammary glands to furnish the young with milk after birth. The generative, urinary, and digestive organs come together behind in a common receptacle, the *cloaca*, or sewer, and their products are discharged by a single orifice. The kidneys of the early embryo, called *Wolffian bodies*, are soon replaced functionally by permanent kidneys, and structurally by the *testes* of the male and the *ovaries* of the female. The cavity of the *abdomen*, or belly, is not separated from that of the *thorax*, or chest, by a complete muscular partition, or *diaphragm*. The great lateral hemispheres of the brain are not connected by a transverse commissure, or *corpus callosum*. Air is always breathed by true lungs, never by gills. The blood, which may be cold or hot, has red oval nucleated corpuscles; the heart has either three or four separate chambers, — the latter in birds, in which the circulation of the hot blood is completely double, *i. e.*, in the lungs and one side of the heart, in the body at large and the other side of the heart. The *aortic* arches are several; or if but one, as in birds, it is the right, not the left as in mammals. The *centra*, or bodies, of the vertebræ are ossified, but have no terminal *epiphyses*. The skull hinges upon the back-bone by a single median protuberance, or *condyle*, and the part bearing the condyle is completely ossified. The lower jaw consists of several separate pieces, the articular one of which hinges upon a movable *quadrate* bone; and there are other peculiarities in the formation of the skull. The ankle-joint is situated, not, as in mammals, between the *tarsal* bones and those of the leg, but between two rows of tarsal bones. The skin is usually covered with outgrowths, in the form of scales or feathers. — Different as

are any living members of the class of Birds from any known Reptiles, the characters of the two groups converge in geologic history so closely, that the presence of *feathers* in the former class, and their absence from the latter, is one of the most positive differences we have found. The oldest known birds are from the Jurassic rocks of Europe, and the Cretaceous beds of North America. These birds had teeth, and various other strong peculiarities of structure, which no living members of the class have retained.

AVES, or the Class of Birds, may be distinguished from other *Sauropsida*, for all that is known to the contrary, by the following sum of characters: The body is covered with feathers, a kind of skin-outgrowth no other animals possess. The blood is hot; the circulation is completely double; the heart is perfectly four-chambered; there is but one (the right) aortic arch, and only one pulmonary artery springs from the heart; the aortic and the pulmonary artery have each three semilunar valves. The lungs are fixed and moulded to the cavity of the chest, and some of the air-passages run through them to admit air to other parts of the body, as under the skin and in various bones. Reproduction is oviparous; the eggs are very large, in consequence of the copious yolk and white; have a hard chalky shell, and are hatched outside the body of the parent. There are always four limbs, of which the fore or pectoral pair are strongly distinguished from the hind or pelvic pair by being modified into *wings*, fitted for flying, if at all, by means of feathers — not of skin as in the cases of such mammals, reptiles, and fishes as can fly. The terminal part of the limb is compressed and reduced, bearing never more than three digits, only two of which ever have claws, and no claws being the rule. There are not more than two separate *carpals*, or wrist-bones, in adult recent birds (with very rare exceptions); nor any distinct interclavicular bone. The clavicles are complete (with rare exceptions), and coalesce to form a "wish-bone" or "merry-thought." The *sternum*, or breast-bone, is large, usually *carinate*, or keeled, and the ribs are attached to its sides only; it is developed from two to five or more centres of ossification. The *sacral* vertebræ proper have no expanded ribs abutting against the *ilia;* the ilia, or haunch-bones, are greatly prolonged forward; the socket for the head of the *femur*, or thigh-bone, is a ring, not a cup; the *ischia* and *pubes* are prolonged backward in parallel directions, and neither of these bones ever unites with its fellow in a ventral symphysis (except in *Struthio* and *Rhea*). The *fibula*, or outer bone of the leg, is incomplete below, taking no part in the ankle-joint. The *astragalus*, or upper bone of the tarsus, unites with the *tibia*, or inner bone of the leg, leaving the ankle-joint between itself and other tarsal bones, the lower of which latter similarly unites with the bones of the instep, or *metatarsus*. There are never more than four metatarsal bones, and the same number of digits; the first or inner metatarsal bone is usually free, and incomplete above; the other three anchylose (fuse) together, and with distal tarsal bones, as already said, to form a compound tarso-metatarsus. Recent birds, at any rate, have a certain saddle-shape of the ends of the bodies of some vertebræ. Such birds have also no teeth and no fleshy lips; the jaws are covered with horny or leathery integument, as the feet are also, when not feathered.

The Position of the Class Aves among other Vertebrates is definite. Birds come in the scale of development next below the Class *Mammalia*, and no close links between Birds and Mammals are known; the most bird-like known mammal, the duck-billed platypus of Australia (*Ornithorhynchus paradoxus*), being several steps beyond any known bird. Birds are the higher one of the two classes of *Sauropsida* — the lower class, *Reptilia*, connecting with the Batrachians (frogs, toads, newts, etc.) and so with the Fishes, *Ichthyopsida*. In this Vertebrate series, Birds constitute what is called a *highly specialized* group; that is to say, a very particular off-shoot, or, more literally, a side-issue, of the Vertebrate genealogical tree, which in the present geological era has become developed into very numerous (about 10,000) species,

closely agreeing with one another in the peculiar sum of their physical characters. In comparison with other classes of Vertebrates, all birds are much alike; there is a less degree of difference among them than that found among the members of any of the other classes of Vertebrates: their likeness to each other being strong, and their kind of difference from any other Vertebrates being peculiar, makes them the "highly specialized" class they are recognized to be. The structural difference between a humming-bird and an ostrich, for example, is not greater in degree than that subsisting between the members of some of the orders of Reptiles: whence some hold, with reason, that Birds should not form a class *Aves*, but an order, or at most a subclass, of *Sauropsida*, and so be compared not with a class *Reptilia* collectively, but with other Sauropsidan orders, such as *Chelonia* (turtles), *Sauria* (lizards), *Ophidia* (serpents), etc. The practical convenience of starting with a "class" *Aves*, however, is so great, that such classificatory value will probably long continue to be ascribed, as heretofore, to Birds collectively. I have spoken of Birds as a particular "side-issue" or lateral branch of the Vertebrate "tree of life": hence it is not to be supposed that they are in the direct line of genealogical descent. Though they stand as a group next below Mammals in the scale of evolution, it does not follow that Mammals were developed from any such creature as a Bird has come to be, any more than that Birds have been evolved from any such Reptiles as those of the present day. It is one of the popular misunderstandings of the Theory of Evolution, to imagine that all the lower forms of animals are in the genetic line of development of the higher forms: that man, for example, was once a gorilla or a chimpanzee — actually such an ape. The theory simply requires all forms of life to be developed from *some* antecedent form, presumably, and in most cases certainly, lower in the scale of organization. Thus man and the gorilla are both descendants of some common progenitor, more or less unlike either of these existing creatures. All mammals are similarly the modified descendants of some more primitive stock, from which stock sprang also all *Sauropsida*, mediately or immediately; therefore, a Mammal is not a modified Bird, though higher in the scale; and, though a Bird is a modified Reptile, it is not a modification of any such snake or lizard as now exists. The most bird-like reptiles known are not the Pterodactyls, or Flying Reptiles (*Pterosauria*), as might be supposed: but of that remarkable order, the *Ornithoscelida*, comprising the Dinosaurians, which "present a large series of modifications intermediate in structure between existing *Reptilia* and *Aves*," and are therefore inferentially in the direct ancestral line of modern Birds.

FIG. 14. — Oldest known ornithological treatise, illustrating also the art of lithography in the Jurassic period, engraved by *Archæopteryx lithographica*. From the original slab in the British Museum; after A. Newton, *Ency. Brit.*

Geologic Succession of Birds. — Birds have been traced back in geologic time to Cretaceous and Jurassic epochs of the Mesozoic or Mid-Life period of the world's history. The earliest *ornith-*

ichnites, — the fossils so called because supposed to indicate the presence of Birds by their foot-prints, were discovered about the year 1835 in the Triassic formation in Connecticut. But the creatures which made these tracks are now reasonably believed to have been all Dinosaurian Reptiles. The oldest *ornitholite*, or fossil certainly known to be that of a true Bird, is the famous *Archæopteryx*, found by Andreas Wagner in 1861 in the Oölitic slate of Solenhofen in Bavaria. This has a long lizard-like tail of twenty vertebræ, from each of which springs a well-developed *feather* on each side; feathers of the wings are also well preserved;

FIG. 15. — Restoration of *Hesperornis regalis*. After Marsh.

bones of the hand are not fused together, as they are in recent Birds; and the jaws bear true teeth. This Bird has served as the basis of one of the primary divisions of the class *Aves;* though it has many reptilian characters, it is a true Bird. The great gap between this ancient Avian and latter-day birds has been to some extent bridged by Marsh's discovery and splendid restoration of Birds from the Cretaceous formations of North America, such genera as *Ichthyornis* and *Hesperornis* forming types of two other primary divisions of the class, *Odontotormæ* and *Odontolcæ*, or Birds with teeth in sockets, and those with teeth in grooves. In both genera the tail is short, as in ordinary birds. In *Ichthyornis*, though the wings are

well developed, with fused metacarpals, and the sternum is keeled, the vertebræ present the extraordinary primitive character of being biconcave. In *Hesperornis* the vertebræ are saddle-shaped, as usual, but the sternum is flat, as in the existing ostriches, and the wings are rudimentary, wanting metacarpals. Some twenty species of several genera of other American Cretaceous Birds have been described by the same author. Remains of Birds multiply in the next period, the Tertiary. Those of the Eocene or early Tertiary are largely and longest known from discoveries made in the Paris Basin, among them the *Gastornis*

FIG. 16.—Restoration of *Ichthyornis victor*. After Marsh.

parisiensis, at least as large as an ostrich; some of these belong to extinct genera, others to genera which still flourish; none are known to have true teeth, or otherwise to be as primitive as the reptile-like forms of the Cretaceous. The Miocene or Middle Tertiary has proven specially rich in remains of Birds, including some of extinct genera, but in largest proportion referable to modern types. Later Tertiary (Pliocene and Post-pliocene) birds are almost all of living genera, and some are apparently of living species. Extinct birds coeval with man, their bones bearing his marks, are found in various caves. Sub-fossil birds' bones occur in shell-heaps (kitchenmiddens) and elsewhere, of course contemporaneous with man, and some

of them scarcely pre-historic. One of the oldest of these is the gigantic *Æpyornis maximus* of Madagascar, of which we have not only the bones, but the egg. The immense Moas, or *Dinornithes* of New Zealand, were among the later of these to die, portions of skin, feathers, etc., of these great creatures having been found. With the Moa-remains are found those of *Harpagornis*, a raptorial bird large enough to have preyed upon the Moas. Finally, various birds have been exterminated in historic times, and some of them within the life-time of persons now living. The Dodo of Mauritius, *Didus ineptus*, is the most celebrated one of these, of the living of which we have documentary evidence down to 1681; the Solitaire of Rodriguez, *Pezophaps solitarius*, the Géant, *Leguatia gigantea*, and several others of the same Mascarene group of islands, are in similar case. The Great Auk, *Alca impennis*, is supposed to have become extinct in 1844; a species of Parrot, *Nestor productus*, was last known to be living in 1851; various parrots and other birds have likewise disappeared within a very few years. At least one North American bird, the Labrador Duck, *Camptolæmus labradorius*, seems likely soon to follow. (A. Newton, *Ency. Brit.*, 9th ed., art. Birds.)

Fig. 17. — Restoration of *Leguatia gigantea*. From Packard, after Schlegel.

§ 2. — PRINCIPLES AND PRACTICE OF CLASSIFICATION.

Having seen what a Bird is, and how it is distinguished from other animals, our next business is to inquire how birds are related to and distinguished from one another, as the basis of

Classification : a prime object of ornithology, without the attainment of which birds, however pleasing they are to the senses, do not satisfy the mind, which always strives to make orderly disposition of its knowledge, and so discover the reciprocal relations and interdependencies of the things it knows. Classification presupposes that there do exist such relations, according to which we may arrange objects in the manner which facilitates their comprehension, by bringing together what is like, and separating what is unlike; and that such relations are the results of fixed, inevitable law. It is, therefore,

Taxonomy (Gr. *τάξις*, *taxis*, arrangement, and *νόμος*, *nomos*, law), or the rational, *lawful* disposition of observed facts. Just as taxidermy is the art of fixing a bird's skin in a natural manner, so taxonomy is the science of arranging birds in the most natural manner; in the way that brings out most clearly their natural affinities, and so shows them in their proper relations to each other. This is the greatest possible help to the memory in its attempt to retain its hold upon great numbers of facts. But taxonomy, which involves consideration of the greatest problems of ornithology, as of every other branch of biology (*biology* being the science of life and living things in general), is beset with the gravest difficulties, springing from our defective knowledge. We could only perfect our taxonomy by having before us a specimen of every kind of bird that exists, or ever existed; and by thoroughly understanding how each is related to and differs from every other one. This is obviously impossible: in point of fact, we do not know all the birds now living, and only a small number of extinct birds have come to light; so that many of the most important links in the chain of evidence are missing, and many more cannot be satisfactorily joined together. With these springs of ignorance and sources of error must be reckoned also the risk of going

wrong through the natural fallibility of the mind. The result is, that the "natural classification," like the elixir of life or the philosopher's stone, is a goal still distant; and as a matter of fact, the present state of the ornithological system is far from being satisfactory. It is obvious that birds, or any other objects, may be "classified" in numberless ways, — in as many ways as are afforded by all their qualities and relations, — to suit particular purposes, or to satisfy particular bents of mind. Hence have arisen, in the history of the science, very many different schedules of classification; in fact, nearly every leader of ornithology has in his time proposed his own "system," and enjoyed a more or less respectable and influential following. Systems have been based upon this or that set of characters, and erected from this or that preconception in the mind of the systematist. Down to quite recent days, the modifications of the external parts of birds, particularly of the bill, feet, wings, and tail, were almost exclusively employed for purposes of classification; and the mental point of view was, that each species of bird was a separate creation, and as much of a fixture in Nature's museum as any specimen in the naturalist's cabinet. Crops of classifications have been sown in the fruitful soil of such blind error, but no lasting harvest has been reaped. The confusion thus engendered has brought about the inevitable reaction; and the fashion of the present day is decidedly the opposite extreme, — that of counting external features of little consequence in comparison with anatomical characters. Too much time has been wasted in arguing the superiority of each of these characters for the purposes of classification; as if a natural classification should not be based upon *all* points of structure! as if internal and external characters were not reciprocal and mutually exponent of each other! But the genius of modern taxonomy seems to be so certainly right, — to be tending so surely, even if slowly, in the direction of the desired consummation, that all differences of opinion, we may hope, soon will be settled, and defect of knowledge, not perversity of the mind, be the only obstacle left in the way of success. The taxonomic goal is not now to find the way in which birds may be most *conveniently* arranged, described, and catalogued; but to discover their *pedigree*, and so construct their family-tree. Such a genealogical table, or *phylum* (Gr. φῦλον, *phulon*, tribe, race, stock), as it is called, is rightly considered the only taxonomy worthy the name, — the only true or *natural* classification. In attempting this end, we proceed upon the belief that, as explained above, all birds, like all other animals and plants, are related to each other *genetically*, as offspring are to parents; and that to discover their genetic relationships is to bring out their true affinities, — in other words, to reconstruct the actual taxonomy of Nature. In this view, there can be but one "natural" classification, to the perfecting of which all increase in our knowledge of the *structure* of birds infallibly and inevitably tends. The classification now in use, or coming into use, is the result of our best endeavors to accomplish this purpose, and represents what approach we have made to this end. It is one of the great corollaries of that theorem of Evolution which most naturalists are satisfied has been demonstrated. It is necessarily a

Morphological Classification; that is, one based solely upon consideration of structure or form (μορφή, *morphē*, form); and for the following reasons: Every offspring tends to take on precisely the structure or form of its parents, as its natural physical heritage; and the principle involved, or the *law of heredity*, would, if nothing interfered, keep the descendants perfectly true to the physical characters of their progenitors; they would "breed true" and be exactly alike. But counter influences are incessantly operative, in consequence of constantly varying external conditions of environment; the plasticity of organization of all creatures rendering them more or less susceptible of modification by such means, they become *unlike* their ancestors in various ways and to different degrees. On a large scale is thus accomplished, by *natural selection* and other natural agencies, just what man does in a small way in producing and maintaining different breeds of domestic animals. Obviously, amidst such ceaselessly

shifting scenes, degrees of likeness or unlikeness of physical structure indicate with the greatest exactitude the nearness or remoteness of organisms in kinship. Morphological characters derived from examination of structure are therefore the surest guides we can have to the blood-relationships we desire to establish; and such relationships *are* the "natural affinities" which all classification aims to discover and formulate. As already said, taxonomy consists in tracing pedigrees, and constructing the *phylum;* it is like tracing any leaf or twig of a tree to its branchlet, this to its bough, this again to its trunk or main stem. The student will readily perceive, from what has been said, the impossibility of *naturally* arranging any considerable number of birds in any *linear series* of groups, one after the other. To do so means nothing more or less than the mechanical necessity of book-making, where groups have to succeed one another, in writing page after page. *Some* groups will follow naturally; others will not; no connected chain is possible, because no such single continuous series exists in nature. In cataloguing, or otherwise arranging a series of birds for description, we simply begin with the highest groups, and make our juxta-positions as well as we can, in order to have the fewest breaks in the series.

Morphology being the safest, indeed the only safe, clue to natural affinities, and the key to all rational classification, the student cannot too carefully consider what is meant by this term, or too sedulously guard against misinterpreting morphological characters, and so turning the key the wrong way. The chief difficulty he will encounter comes from *physiological adaptations of structure;* and this is something that must be thoroughly understood. The expression means that birds, or any animals, widely different in the sum of their morphological characters, may have certain parts of their organization modified in the same way, thus bringing about a seemingly close resemblance between organisms really little related to each other. For example: a phalarope, a coot, and a grebe, all have *lobate* feet; that is, their feet are fitted for swimming purposes in the same way, namely, by development of flaps or lobes on the toes. A striking but very superficial and therefore unimportant resemblance in a certain particular exists between these birds, on the strength of which they used to be classed together in a group called *Pinnatipedes*, or "fin-footed" birds. But, on sufficient examination, these three birds are found to be very unlike in other respects; the sum of their unlikenesses requires us to separate them quite widely in any natural system. The group *Pinnatipedes* is therefore unnatural, and the appearance of affinity is proven to be deceptive. Such resemblance in the condition of the feet is simply functional, or physiological, and is not correspondent with structural or morphological relationships. The relation, in short, between these three birds is *analogical;* it is an inexact superficial resemblance between things profoundly unlike, and therefore having little *homological* or exact relationship. *Analogy* is the apparent resemblance between things really unlike, — as the wing of a bird and the wing of a butterfly, as the lungs of a bird and the gills of a fish. *Homology* is the real resemblance, or true relation between things, however different they may appear to be, — as the wing of a bird and the fore-leg of a horse, the lungs of a bird and the swim-bladder of a fish. The former commonly rests upon mere functional, *i. e.* physiological, modifications; the latter is grounded upon structural, *i. e.* morphological, identity or unity. Analogy is the correlative of physiology, homology of morphology; but the two may be coincident, as when structures identical in morphology are used for the same purposes and are therefore physiologically identical. Physiological diversity of structure is incessant, and continually interferes with morphological identity of structure, to obscure or obliterate the indications of affinity the latter would otherwise express clearly. It is obvious that birds might be classified physiologically, according to their adaptive modifications or analogical resemblances, just as readily as upon any other basis: for example, into those that perch, those that walk, those that swim, etc.; and, in fact, most early classifications largely rested upon such considerations. It is also evi-

dent, that when functional modifications happen to be *coincident* with structural affinities, — as when the turning of the lower larynx into a music-box coincides with a certain type of structure, — such modifications are of the greatest service in classification, as corroborative evidence. But since all sound taxonomy rests on morphology, on real structural affinity, we must be on our guard against those physiological "appearances" which are proverbially "deceptive." I trust I make the principle clear to the student. Its practical application is another matter, only to be learned in the school of experience. This matter of

Homology or Analogy may be thus summed: Birds are *homologically related*, or naturally allied or affined, according to the sum of like structural characters employed for similar purposes; they are *analogically related*, only according to the sum of unlike characters employed for similar purposes. A loon and a cormorant, for instance, are closely affined, because they are both fitted in the same way for the pursuit of their prey by flying under water. A dipper (family *Cinclidæ*) and a loon (family *Colymbidæ*) are analogous, in so far as both are fitted to pursue their prey by flying under water; but they stand near opposite extremes of the ornithological system; they have little affinity beyond their common birdhood; very different structure being modified to attain the same end. So again, conversely, the crow has vocal organs almost identical in structure with those of the nightingale, and the organization of the two birds is in other respects very similar; their affinity or homology is therefore close, though the crow is a hoarse croaker, the nightingale an impassioned musician.

The Reason why Morphological Classification is so important as to justify or even require its adoption has been very clearly stated by Huxley, whose words I cannot do better than quote in this connection. Speaking of animals, not as physiological apparatuses merely; not as related to other forms of life and to climatal conditions; not as successive tenants of the earth; but as fabrics, each of which is built upon a certain plan, he continues: "It is possible and conceivable that every animal should have been constructed upon a plan of its own, having no resemblance whatever to the plan of any other animal. For any reason we can discover to the contrary, that combination of natural forces which we term Life might have resulted from, or been manifested by, a series of infinitely diverse structures; nor would anything in the nature of the case lead us to suspect a community of organization between animals so different in habit and in appearance as a porpoise and a gazelle, an eagle and a crocodile, or a butterfly and a lobster. Had animals been thus independently organized, each working out its life by a mechanism peculiar to itself, such a classification as that now under contemplation would be obviously impossible; a morphological or structural classification plainly implying morphological or structural resemblances in the things classified.

"As a matter of fact, however, no such mutual independence of animal forms exists in nature. On the contrary, the members of the animal kingdom, from the highest to the lowest, are marvellously connected. Every animal has something in common with all its fellows; much, with many of them; more, with a few; and usually, so much with several, that it differs but little from them.

"Now, a morphological classification is a statement of these gradations of likeness which are observable in animal structures, and its objects and uses are manifold. In the first place, it strives to throw our knowledge of the facts which underlie, and are the cause of, the similarities discerned, into the fewest possible general propositions, subordinated to one another, according to their greater or less degree of generality; and in this way it answers the purpose of a *memoria technica*, without which the mind would be incompetent to grasp and retain the multifarious details of anatomical science.

"But there is a second and even more important aspect of morphological classification. Every group in that classification is such in virtue of certain structural characters, which are

not only common to the members of the group, but distinguish it from all others; and the statement of these constitutes the definition of the group.

"Thus, among animals with vertebræ, the class *Mammalia* is definable as those which have two occipital condyles, with a well ossified basi-occipital; which have each ramus of the mandible composed of a single piece of bone and articulated with the squamosal element of the skull; and which possess mammæ and non-nucleated red blood-corpuscles.

"But this statement of the characters of the class *Mammalia* is something more than an arbitrary definition. It does not merely mean that naturalists agree to call such and such animals *Mammalia:* but it expresses, firstly, a generalization based upon, and constantly verified by, very wide experience; and, secondly, a belief arising out of that generalization. The generalization is that, in nature, the structures mentioned are always found associated together; the belief is that they always have been, and always will be, found so associated. In other words, the definition of the class *Mammalia* is a statement of a law of correlation, or coexistence, of animal structures, from which the most important conclusions are deducible." (Introd. to Classif. of Animals, 8vo, London, 1869, pp. 2, 3.)

But broad as such laws of correlation of structure are, and important as are the conclusions deducible, we must constantly be on our guard against presuming upon the infallibility either of the data or of the deduction, as the author just quoted goes on to show. Such caution is specially required where there is no obvious reason for the particular combination that may be found to exist. In the case of the ostrich-like birds (*Ratitæ*), for example, we can understand how a flat, unkeeled breast-bone, a particular arrangement of the shoulder-bones, and a rudimentary state of the wing-bones, are found in combination, because all these modifications of structure are evidently related to loss of the power of flight; and, in point of fact, no exception is known to the generalization, that such conditions of the sternal, coraco-scapular, and humeral bones always coexist. But in all known struthious (ratite) birds, this state of the bones in mention coexists also with a peculiar modification of the bones of the palate, and no necessary connection between these two sets of diverse characters is conceivable. Now, if we only knew struthious birds, and found the combination in mention to hold with them all, we should doubtless declare our belief, that any bird having such palatal characters would also be found to possess such imperfect wing-apparatus. But this would be going too far: in fact, we know that the tinamous (*Dromæognathæ*) have such a palate, yet have a keeled sternum and functionally developed wings. The real use and proper application of such generalizations is to teach the lesson, that creatures exhibiting such modified combinations of characters are genetically related to each other just in the degree to which they possess characters in common, and are genetically remote from each other in the degree to which they do not possess characters in common: *i. e.*, that their similarities and distinctions of structure are sure indexes of their natural affinities. To take another case, derived from consideration of a large number of existing birds: it is an observed fact, that a particular arrangement of the plates upon the back of the tarsus, a peculiar modification of the lower larynx or voice organ, and an undeveloped or abortive condition of the first large feather on the hand, are found associated in a vast series of birds, constituting the group of *Passeres* called *Oscines.* What possible connection there can be between these three separate and apparently independent modifications we cannot even surmise; but that they have some natural and necessary connection we cannot doubt, and that the connection is causal, not fortuitous, is a logical inference from the observed fact, that birds which present this particular combination are also closely related in other structural characters; that is, that they have all been subjected to operative influences which have conspired to produce the modifications observed. Given, then, a bird with a known oscine larynx, but unknown as to its feet and wings, it would be a reasonable inference that these members, when discovered, would present the characters observed to occur in like cases. But the first lark (*Alaudidæ*) examined would show the inference to be fallible;

for the tarsus of such a bird is differently disposed, though a lark has an elaborate singing apparatus, and only nine instead of ten developed primaries. Once more: the development of a keeled sternum, a peculiar saddle-shape of certain vertebræ, and lack of true teeth, are characters coexisting in all the higher birds; and, as far as these birds are concerned, we have no hint that such a combination is ever broken. In fact, however, the singular Cretaceous *Ichthyornis* shows us a pattern of bird in which a well-keeled sternum and perfectly formed wing coexist with teeth in reptile-like jaws and with fish-like biconcave vertebræ. What we learn from this case indeed breaks down one of the most precise definitions we might have made (and indeed did make) respecting birds at large; but in its failure we are taught how great is the modification of geologically recent birds from their primitive generalized ancestry: we learn something likewise of the steps of such modification, and of the length of time required for the process. It is the history of attempts to frame definitions of groups in zoölogy, that they are all liable to be negatived by new discoveries, and therefore to be broken down and require remodelling as our knowledge increases. It is to be readily perceived that the ability to draw distinctions and make definitions of groups is as much the *gauge of our ignorance* as the test of our knowledge; for all groups, like all species, come to be such by modification so gradual, so slight in each successive increment of difference, that, if all the steps of the process were before our eyes, we should be able to limit no groups whatever in a positive, unqualified manner. All would merge insensibly into one another, be inseparably linked in as many series as there have been actual lines of evolutionary progress, and finally converge to the one or few starting points of organized beings.

Practically, however, the case is quite the reverse, — happily for the comfort of the working naturalist, however sadly the philosopher may deplore the ignorance implied. Degrees of likeness and unlikeness do exist, which when rightly interpreted enable us to mark off groups of all grades with much facility and precision, and thus erect a morphological classification which recognizes and defines such degrees, and explains them upon the principles of Evolution. The way in which the principles of such classification are to be practically applied gives occasion for some further remarks upon

Zoölogical Characters. — A "character," in zoölogical language, is any point of structure which may be perceived and described for the purpose of comparing or contrasting animals with one another. Thus, the conditions of the sternum, palate, tarsus, larynx, as noted in preceding paragraphs, are each of them "characters" which may be used in describing individual birds, or in framing definitions of groups of birds. Morphological characters, with which the classification we have adopted alone concerns itself, may be derived from the structure of a bird considered in any of its relations, or as affected by any of the conditions to which it is subjected. Thus *embryological* characters are those afforded by the bird during the progress of its development in the egg, from the almost structureless germ to the fully formed chick. Such characters of the embryo in its successive stages are of the utmost significance; for it is a fact, that the germ of each of the higher organisms goes through a series of developmental changes which, at each succeeding step in the unfolding of its appropriate plan of structure, causes it to resemble the adult state of animals lower than itself in the scale of organization. In fine, the history of the evolution of every *individual* bird epitomizes the history of those changes which birds collectively have undergone in becoming what they are by modified descent from lower organisms. Such transitory stages of any embryo, therefore, give us glimpses of those evolutionary processes which have affected the group to which it belongs. Any bird, for example, when a germ, is at first on the plane of organization of the very lowest known creatures, — one of the *Protozoa*. As its germ develops, and its structure becomes more complicated by the formation of parts and organs successively differentiated and specialized, it rises higher and higher in the scale of being. At a certain stage very early reached

(for the steps by which it becomes like any *in*vertebrate are very speedily passed over), it resembles a fish in possessing gill-like slits, several aortic arches, no true kidneys, no amnion, etc. Further advanced, losing its gills, gaining kidneys and amnion, etc., it rises to the dignity of a reptile, and at this stage it is more like a reptile than like a bird; having, for example, a number of separate bones of the wrist and ankle, no feathers, etc. The assumption of its own appropriate characters, *i. e.* those by which it passes from a reptilian creature to become a bird, is always the last stage reached. We can thus actually see and note, inside any egg-shell, exactly those progressive steps of development of the individual bird which we believe to have been taken on a grand scale in nature for the evolution of the class *Aves* from lower forms of life; and the lesson learned is fraught with significance. It is nothing less than the demonstration in *ontogeny* (genesis of the individual) of that *phylogeny* by which groups of creatures come to be. The interior of any adult bird, again, furnishes us with all kinds of ordinary *anatomical* characters, derived from the way we perceive the different organs and systems of organs to be fashioned in themselves, and arranged with reference to one another. The finishing of the outward parts of a bird gives us the ordinary *external* characters, in the way in which the skin and its appendages are modified to form the covering of the bill and feet, and to fashion all kinds of feathers. Birds being of opposite sexes, and such difference being not only indicated in the essential sexual organs, but usually also in modifications in size or shape of the body or quality of the plumage and other outgrowths, a set of *sexual* characters are at our service. Birds are also sensibly modified in their outward details of feathering by times of the year when the plumage is changed, and this renders appreciation of *seasonal* characters possible. All such circumstances, and others that could be mentioned, such as effects of climate, of domestication, etc., in so far as they in any way affect the *structure* of birds, conspire to produce zoölogical "characters," as these are above defined. Such characters, according as they result from more or less profound impressions made upon the organism, are of more or less "value" in taxonomy; being of all grades, from the trivial ones that serve to distinguish the nearest related species or varieties, to the fundamental ones that serve to mark off primary divisions. Thus the "character" of possessing a backbone is common to all animals of an immense series, called *Vertebrata*. The "character" of feathers is common to all the class *Aves;* of toothless jaws to all modern birds; of a keeled sternum to all the sub-class *Carinatæ;* of feet fitted for perching to all *Passeres;* of a musical apparatus to all *Oscines;* of nine primaries to all *Fringillidæ;* of crossed mandibles to all of the genus *Loxia;* of white bands on the wings to all of the species *Loxia leucoptera*. There is thus seen a sliding scale of valuation of characters, from those involving the most profound or *primitive* modifications of structure to those resting upon the most superficial or *ultimate* impressions. It will also be obvious, that every ulterior modification presupposes inclusion of all the prior ones; for a white-winged crossbill, to be itself, must be a loxian, fringilline, oscine, passerine, carinate, modern, avian, vertebrated animal. The more characters, of all grades, that any birds share in common, the more closely are they related, and conversely. Obviously, the possession of more or fewer characters in common results in

Degrees of Likeness. — Were all birds alike, or did they all differ by the same characters to the same degree, no classification would be possible. It is a matter of fact, that they do exhibit all degrees of likeness possible within the limits of their Avian nature; it is a matter of belief, that these degrees are the necessary result of Evolution, — of descent with modification from a common ancestry; and that being dependent upon that process, they are capable of explaining it if rightly interpreted. For example: Two white-winged crossbills, hatched in the same nest, scarcely differ perceptibly (except in sexual characters) from each other and from the pair that laid the eggs. We call them "specifically" identical; and the sum of the differences by which they are distinguished from any other kinds of crossbills is their "specific

character." All the individual crossbills which exhibit this particular sum constitute a "species." In this case, the genetic relationship of offspring and parent is unquestionable, — it is an observed fact. Now turn to the extremely opposite case. The difference between our crossbills and the Cretaceous *Ichthyornis* is enormous: I suppose it is nearly the greatest known to subsist between any two birds whatsoever. But the *Ichthyornis* and the *Loxia* are also separated by a correspondingly immense interval of *time*, and presumably by correspondingly enormous differences in *conditions of environment*, — in their physical surroundings. It is a logical inference that these two things — difference in physical structure, and difference in physical environment — are in some way correlated and coördinated. If we presume, upon the theory of evolution, that despite the great difference, a crossbill is genetically related to some such bird as an *Ichthyornis*, as truly as it is to its actual parents, only much more remotely, and that the difference is due to modifications impressed upon its stock in the course of time, conformably with changing conditions of environment, we shall have a better explanation of the difference than any other as yet offered, — an explanation, moreover, which is corroborated by all the related facts we know, and with which no known facts are irreconcilable. But to correctly gauge and formulate the degrees of likeness or unlikeness between any two birds is to correctly "classify" them; and if these degrees rest, as we believe they do, upon nearness or remoteness of genetic relationship, classification upon such basis becomes the truest attainable formulation of "natural affinities." It is the province of morphological classification to search out those natural affinities which the structure of birds indicates, and express them by dividing birds into groups, and subdividing these into other groups, of greater or lesser "value," or grade, according to the more or fewer characters shared in common, — that is, according to degrees of likeness; that is, again, according to genealogical relationship or consanguinity.

Zoölogical Groups. — To carry any scheme of classification into practical effect, naturalists have found it necessary to invent and apply a system of grouping objects whereby the like may come together and be separated from the unlike. They have also found it expedient to give names to all these groups, of whatever grade, such as *class*, *order*, *family*, *genus*, *species*, etc.; and to stamp each such group with the *value* of its grade, or its relative rank in the scale, so that it may become currency among naturalists. The student must observe, in the first place, that the value of each such coinage is wholly arbitrary, until sanctioned and fixed by common consent. The term "class," for example, simply indicates that naturalists agree to use that word to designate a conventional group of a particular grade or value. Indispensable as is some such acceptable medium of exchange of ideas among naturalists, their groups are *not* fixed, have *no* natural value, and in fact have no actual existence in the treasury of Nature. It cannot be too strongly impressed upon the student that Nature makes no bounds, — *Natura non facit saltus;* there are no such abrupt transitions in the unfolding of Nature's plan, no such breaks in the chain of being, as he would be led to suppose by our method of defining and naming groups. He must consider the words "class," "order," etc., as wholly arbitrary terms, invented and designed to express our ideas of the *relations* which subsist between any animals or sets of animals. Thus, for example, by the term the "Class of Birds" we signify simply the kind and degree of likeness which all birds share, such being also the kind and degree of their unlikeness from any other animals; the word "class" being simply the name or handle of the generalization we make respecting their relations with one another and with other animals; it represents an abstract idea, is the expression of a relation. True, all birds *embody* the idea; but "class" is nevertheless an abstraction. Now, as intimated earlier in this essay, the definition of the idea we attach to the term — the limitation of the class *Aves* — depends entirely upon how much we know of the relation intended to be expressed. It so happens, that no animals are known

which cannot be decided to belong, or not to belong, to the conventional class of birds, because we have found it convenient and expedient to consider the presence of feathers a fair criterion, or necessary qualification. But what, when an animal is discovered the covering of whose body is half-way between the scales of a lizard and the plumes of a bird, and whose structure is otherwise as equivocal? This may happen any day. A feather is certainly a modified scale; a feather has doubtless been developed out of a scale. In the case supposed, we should have to modify our definition of the "Class of Birds"; that is, change our ideas upon the subject, and alter the boundary-line we established between the classes of birds and reptiles; whereas, were a "class" something naturally definite, independent, and fixed, all that we could learn about it would only tend to establish it more surely. The same obscurity and uncertainty of definition attaches to groups of every grade — from the Animal "Kingdom" itself, which cannot be cut clear of the Vegetable "Kingdom" — down through classes, orders, families, genera, species, and varieties — yes, to the *individual* itself which, however unmistakable among higher organisms, cannot always be predicated of the lowermost forms of Life. Such divisions, of whatever grade, as we are able to establish for the purposes of classification, depend entirely upon the breaks and defects in our knowledge. There is no such thing as drawing "hard and fast" lines anywhere, for none such exist in Nature.

Taxonomic Equivalence of Groups. — But, however arbitrary they may be, or however obscure or fluctuating may be their boundaries, groups we must have in zoölogy, and groups of different grades, to express different degrees of likeness of the objects examined, and so to "classify" them. It is a great convenience, moreover, to have a recognized sliding-scale of valuation of groups from the highest to the lowest, and an accepted valuation. Just as in a thermometric scale, there are "degrees" designated as those of the boiling-point of water, the heat of the blood, the freezing of water, of mercury, etc.; so there are certain degrees of likeness conventionally designated as those of *class*, *order*, *family*, *genus*, and *species*; always accepted in the order here given, from higher to lower groups. (There are various others, and especially a number of intermediate groups, generally distinguished by the prefix *sub-*, as *subfamily*; but those here given are generally adopted by English-speaking naturalists, and suffice to illustrate the point I wish to make.) It may sound like a truism to say, that groups of the same grade bearing the same name, whatever that may be, must be of the same value, — must be based upon and distinguished by characters of equal or equivalent importance. *Equivalence of groups* is necessary to the stability and harmony of any classificatory system. It will not do to frame an order upon one set of characters here, and there a family upon a similar set of characters; but order must differ from order, and family from family, by an equal or corresponding amount of difference. Let a group called a family differ as much from the other families in its own order as it does from some other order, and by this very circumstance it is not a family but an order itself. It seems a very simple proposition, but it is too often ignored, and always with practical ill result. Two points should be remembered here: First, that absolute size or numerical bulk of a group has nothing to do with its taxonomic value: one order may contain a thousand species, and another be represented by a single species, without having its ordinal valuation affected thereby. Secondly, any given character may assume different importance, or be of different value, in its application to different groups. Thus, the number of primaries, whether nine or ten, is a family character almost throughout *Oscines*; but in one oscine family (*Vireonidæ*) it has scarcely generic value. It is difficult, however, to determine such a point as this without long experience. Nor is it possible, in fact, to make our groups correspond in value with entire exactitude. The most we can hope for is a reasonable approximation. As in the thermometric simile above given, "blood heat" and other points fluctuate, so does order not always correspond with order, nor family with family, in actual significance. What degree of difference shall be "ordinal"? What shall

be a difference of "family"? What shall be "generic" and what "specific" differences? Such questions are more easily asked than answered. They demand critical consideration.

Valuation of Characters. — In a general way, of course, the greater the difference between any two objects, the more "important" or "fundamental" are the "characters" by which they are distinguished. But what makes a character "important" or the reverse? Obviously, what it signifies represents its importance. We are classifying morphologically, and upon the theory of Evolution; and in such a system a character is important or the reverse, simply as an exponent of the principles, or an illustration of the facts, of evolutionary processes of Nature, according to the unfolding of whose plans of animal fabrics the whole structure of living beings has been built up. Why is the possession of a back-bone such a "fundamental" character that it is used to establish one of the primary branches of the animal kingdom? It is not because so many millions of creatures possess it, but because it was introduced so early in the evolutionary process, and because its introduction led to the most profound modification of the whole structure of the animals which became possessed of a vertebral column. Why is the possession by a bird of biconcave vertebræ so significant? Not because all modern birds have saddle-shaped vertebræ, but because to have biconcave vertebræ is to be *quoad hoc* fish-like. Why is presence or absence of teeth so important? Not that teeth served those old birds better than a horny beak serves modern ones, but because teeth are a reptilian character. Obviously, to be fish-like or reptile-like is to be by so much unbird-like: the degree of difference thus indicated is enormous; and a character that indicates such degree of difference is proportionally "important" or "fundamental," — just what we were after. By knowledge of facts like these, and by the same process of reasoning, a naturalist of tact, sagacity, and experience is able to put a pretty fair valuation upon any given character; he acquires the faculty of perceiving its significance, and according to what it signifies does it possess for him its taxonomic importance. As a matter of fact, it seems that characters of all sorts are to be estimated *chronologically*. For, if animals have come to be what they are by any process that took time to be accomplished, the characters earliest established are likely to be the most fundamental ones, upon the introduction of which the most important train of consequences ensue. Feathers, for example, as the *Archæopteryx* teaches us, were in full bloom in the Jurassic period, and they are still the most characteristic possession of birds: all birds have them; they are a class character. If they had been taken on quite recently, we may infer that many creatures otherwise entirely avian might not possess them, and they would have in classification less significance than that now rightly attributed to them. On the other hand, we cannot suppose that the finishing touches, by which, in the presence of white bands on the wings of *Loxia leucoptera*, and their absence in *Loxia curvirostra*, these two "species" are distinguished, were not very lately given to these birds. It is a very late step in the process, and correspondingly insignificant; it is of that value or importance which we call "specific." The same method of reasoning is available for determining the value of any character whatever, and so of estimating the grade of the group which we establish upon such character. As a rule, therefore, the length of time a character has been in existence, and its taxonomic value, are correlated, and each is the exponent of the other.

"Types of Structure." — In no department of natural history has the late revolution in biological thought been more effective than in remodelling, presumably for the better, the ideas underlying classification. In earlier days, when "species" were supposed to be independent creations, it was natural and almost inevitable to regard them as fixed facts in nature. A species was as actual and tangible as an individual, and the notion was, that, given any two specimens, it should be perfectly possible to decide whether they were of the same or different species, according to whether or not they answered the "specific characters" laid down for

them. The same fancy vitiated all ideas upon the subject of genera, families, and higher groups. A "genus" was to be discovered in nature, just like a species; to be named and defined. Then species that answered the definition were "typical"; those that did not do so well were "sub-typical"; those that did worse, were "aberrant." A good deal was said of "types of structure," much as if living creatures were originally run into moulds, like casting type-metal, to receive some indelible stamp; while — to carry out my simile — it was supposed that by looking at some particular aspect of such an animal, as at the face of a printer's type, it could be determined in what box in the case the creature should be put; the boxes themselves being supposed to be arranged by Nature in some particular way to make them fit perfectly alongside each other by threes or fives, or in stars and circles, or what not. How much ingenuity was wasted in striving to put together such a Chinese puzzle as these fancies made of Nature's processes and results, I need not say; suffice it, that such views have become extinct, by the method of natural selection, and others, apparently better fitted to survive, are now in the struggle for existence. Rightly appreciated, however, the expression which heads this paragraph is a proper one. There are numberless "types of structure." It is perfectly proper to speak of the "vertebrate type," meaning thereby the whole plan of organization of any vertebrate, if we clearly understand that such a type is not an independent or original model conformably with which all back-boned animals were separately created, but that it is one modification of some more general plan of organization, the unfolding of which may or did result in other besides vertebrated animals; and that the successive modifications of the vertebrate plan resulted in other forms, equally to be regarded as "types," as the reptilian, the avian, the mammalian. Upon this understanding, a group of any grade in the animal kingdom is a "type of structure," of more general or more special significance, presumably according to the longer or shorter time it has been in existence. An individual specimen is "typical" of a species, a species is "typical" of a genus, etc., if it has not had time enough to be modified away from the characters which such species or genus expresses. Any set of individuals, that is, any progeny, which become modified to a degree from their progenitors, introduce a new type; and continually increasing modification makes such a type specific, generic, and so on, in succession of time. There must have been a time, for example, when the Avian and Reptilian "types" began to diverge from each other, or, rather, to branch apart from their common ancestry. In the initial step of their divergence, when their respective types were beginning to be formed, the difference must have been infinitesimal. A little further along, the increment of difference became, let us say, equivalent to that which serves to distinguish two species. Wider and wider divergence increased the difference till genera, families, orders, and finally the classes of *Reptilia* and *Aves*, became established. In one sense, therefore, — and it is the usual sense of the term, — the "type" of a bird is that one which is *furthest removed from* the reptilian type, — which is most highly *specialized* by differentiation to the last degree from the characters of its primitive ancestors. One of the *Oscines*, as a thrush or sparrow, would answer to such a type, having lost the low, primitive, *generalized* structure of its early progenitors, and acquired very special characters of its own, representing the extreme modification which the stock whence it sprung has undergone. In a broader sense, however, the type of a bird is simply the stock from which it originated; and in such sense the highest birds are the least typical, being the furthest removed and the most modified derivations of such stock, the characters of which are consequently remodelled and obscured to the last degree. Two opposite ideas have evidently been confused in the use of the word "Type." They may be distinguished by inventing the word *teleotype* (Gr. τέλεος, *teleos*, final, *i. e.*, accomplished or determined; formed like *teleology*, etc.) in the usual sense of the word type, and using the word we already possess, *prototype* (Gr. πρῶτος, *protos*, first, leading, determining), in the broader sense of the earlier plan whence any teleotype has been derived by modification. This, *Ichthyornis* or *Archæopteryx* is prototypic of modern birds,

any of which are teleotypic of their ancestors. It may be further observed that any form which is teleotypic in its own group, is prototypic of those derived from it. Thus, the *Archæopteryx*, so prototypic of modern birds, was a very highly specialized teleotype of its own ancestry. A little reflection will also make it clear that the same principle of antitypes (opposed types) is applicable to any of our *groups* in zoölogy. *Any group is teleotypic of the next greater group of which it is a member: prototypic of the next lesser one.* Any species is teleotypic of its genus; any genus, of its family; any family, of its order; and conversely; that is to say, any species represents one of the ulterior modifications of the plan of its genus. The Class of Birds, for example, is one of the several teleotypes of Vertebrata, *i. e.*, of the vertebrate plan of structure; representing, as it does, one of several ways in which the vertebrate prototype is accomplished. Conversely, the Class of Birds is prototypical of its several orders, representing the plan which these orders severally unfold in different ways. And so on, throughout any series of animals, backwards and forwards in the process of their evolution; any given form being teleotypic of its predecessors, prototypic of its successors. All existing forms are necessarily teleotypic, — only prototypic for the future. Prototype, in the sense here conveyed, indicates what is often expressed by the word *archetype*. But the latter, as I understand its use by Owen and others, signifies an ideal plan never actually realized: the "archetype of the vertebrate skeleton," for example, being something no vertebrate ever possessed, but a theoretical model — a generalization from all known skeletons. The correspondence of my use of "prototypic" with a common employ of "archetypic," and of "teleotypic" as including both "attypic" and "etypic," is noted below.[1]

The actual and visible genetic relationships of living forms being practically restricted to individuals of the same species, — parents and offspring "specifically" identical, — it would seem at first sight that species must be the modified descendants of their respective genera, in order to be teleotypic of any such next higher group. But nothing descends from a genus, or any other group; everything descends from individuals; a "genus," like any other group, is an abstract statement of a relation, not a begetter of anything. To illustrate: the "genus *Turdus*" is represented, let us say, by a score of species: if these species be rightly allocated in the genus, they are all the modified descendants of a form which was, before they severally branched off, a specific form; and the "genus *Turdus*" in the abstract is simply that form; and that form is prototypic of its derivatives. In the concrete, as represented by its teleotypes, the genus *Turdus* sums the modifications which these have collectively undergone, without specifying the particular modifications of any of them; it expresses the way in which they are all like one another, and in which they are all unlike the representatives of any other genus. Thus what is above advanced is seen to hold, though genera and all other groups are actual descendants of individuals specifically identical.

Generalized and Specialized Forms. — Taking any one group of animals — say the genus *Turdus*, of numerous species — and considering it apart from any other group, we perceive that it represents a certain assemblage of characters peculiar to itself, aside from those more fundamental ones it includes of its family, order, etc. Its particular characters we call "generic." Among the numerous teleotypic forms it includes, there is a wide range of specific variation,

[1] "*Archetypical* characters are those which a group derives from its progenitor, and with which it commences, but which in much modified descendants are lost; such, for example, is the dental formula of the Educabilia (M $\frac{3}{3}$ PM $\frac{4}{4}$ C $\frac{1}{1}$ I $\frac{3}{3} \times 2$), — a formula, as shown by Owen, very prevalent among early members of the group, but generally departed from more or less in those of the existing faunas. *Attypical* characters are those to the acquisition of which, as a matter of fact, we find that forms, in their journey to a specialized condition, tend . . . *Etypical* characters are exceptional ones, and which are exhibited by an eccentric offshoot from the common stock of a group." — (*Gill*, Pr. Am. Assoc. Adv. Sci., XX, 1873, p. 293.) To illustrate in birds: A generalized lizard-like type of sternum is *archetypic* of any bird's sternum. The sternum of the lizard-like animals whence birds actually descended is *prototypic*: the keeled sternum of a carinate bird is *attypical* in most birds, *etypical* in the peculiar state in which it is found in *Stringops*; but equally *teleotypic* in both instances.

within the limits of generic relationship. Some of its species are modified further away than some others are from the generic standard or type to which all conform more or less perfectly. The former, having more peculiarities of their own, are said to be the most *specialized;* the latter, having fewer peculiarities, are the least specialized. Those that are the least specialized are obviously the most *generalized;* and this means, that we believe them to be nearest to the stock whence all have together descended with modification. The application of this illustration to great groups shows us the principle upon which any form is said to be *generalized* or *specialized.* The *Ichthyornis*, with its fish-like vertebræ, reptile-like teeth, bird-like sternum and shoulder-girdle, is a very generalized form. A thrush is the opposite extreme of a highly specialized form. The two are also separated by an enormous interval of time: one being very old, the other quite new; a chronological sequence is here perceived. Since the evolutionary processes concerned in the modification on the whole represent progress from simplicity to complexity of organization, and therefore ascent in the scale of organization, a *generalized* type, an *ancient* type, and a *simple* type are on the whole synonymous, and to be contrasted with forms *specialized, recent,* and *complex.* They therefore respectively correspond to

"Low" and "High" in the Scale of Organization. — All existing birds are very closely related, notwithstanding the great numerical preponderance of the class in the present geological epoch. This outbreak, as it were, of birds upon the modern scene, is like the nearly simultaneous bursting into bloom of a mass of flowers at the end of one branch of the Sauropsidan stem. All modern birds, in fact, are strongly specialized forms, so much so that it is difficult to predicate "high" or "low" within such a narrow scale. The great group *Passeres*, for example, comprehending a majority of all known birds, is scarcely more different from other birds than are the families of reptiles from each other, and among *Passeres* we have little to go upon in deciding "high" or "low" beyond the musical ability of *Oscines.* It is hard to see much difference in actual complexity of organization between those birds regarded as the lowest, as an ostrich or a penguin, and those conceded to be highest, as a swallow or sparrow. Nevertheless, in a larger perspective, as between a fish, a reptile, and a bird, the student will readily perceive the bearing of the ideas attached to the terms "low" and "high" in the scale of organization. Creatures rise in the scale by a number of correlated modifications and in the course of time (for it takes *time* to evolve a class of birds from sauropsidan stock as really as it does to develop the germ of an egg into the body of a chick). Progressive differentiation and specialization of structure and function in due course elaborates diversity from sameness, complexity from simplicity, the "high" special from the "low" general plan of organization; the culmination in man of the vertebrate type, first faintly foreshadowed in the embryonic Ascidian. No one should venture to foretell the result of infinitesimal increments in elevation of structure and function, nor presume to limit the infinite possibilities of evolutionary processes, either in this actual world or in the foretold next one.

As to "evidences of design" in the plan of organized beings, it may be said simply that every creature is perfectly "designed" or fitted for its appropriate activities, and perfectly adapted to its conditions of environment. In fact, it must be so fitted and adapted, or it would perish. Whether it so determines itself, or is so determined, is a teleological question. The truth remains that every creature is perfect in its own way. A worm is as perfectly fitted to be a worm, as is a bird to be a bird; in fact, were it not, it would either turn into something else, or cease to be. A spade is as perfect an organization *of the spade kind*, as is a steam-engine of that kind of an organization; though the difference in complexity of structure and functional capacity, like that between the lowly organized ascidian generality and the highly organized avian speciality, is enormous.

One word more: The class of mammals is highest in the scale of organization. The class of birds is next highest. But it does not follow, from this relation sustained by *Mam-*

malia and *Aves* collectively, that every mammal must be more highly organized than every bird. It is difficult to say how a mole or a mouse is a more elaborate or more capable creature than a canary-bird, physically or mentally. The relative rank of two groups is determined by balancing the aggregate of their structural characters. In large series, the average of development, not the extremes either way, is taken into account; so that the lowest members of a higher group may be below the highest members of the next lower group. The common phrase, "below par," or "above par," is most applicable to such cases.

Machinery of Classification. — The inexperienced student may be glad to be given some explanation of the way in which the taxonomic principles we have discussed are applied, and carried into practical effect in classifying birds. Our machinery for that purpose is our inheritance from those naturalists who held very different views from those which touch the evolutionary key-note of modern classification. It is clumsy, and does not work well as a means of expressing the relations we now believe to be sustained by all organisms toward one another; but it is the best we have. Systematic zoölogy, or the practice of classification, has failed to keep pace with the principles of the science; we are greatly in need of some new and sharper "tools of thought," which shall do for zoölogy what the system of symbols and formulæ have done for chemistry. *We want some symbolic formulation of our knowledge.* The invention of a practicable scheme of classification and nomenclature, which should enable us to formulate what we mean by *Turdus migratorius*, as a chemist symbolizes by SO_4H_2 what he understands hydrated sulphuric acid to be, would be an inestimable boon to working naturalists. The mapping out of groups with connecting lines to indicate their genetic relations, in the form of a "phylum," is a common practice; but that, like any other pictorial representation of a "family tree," is not the graphic symbolization required. The first steps in this direction have been tentatively taken already by the late Mr. A. H. Garrod and others: we already have a mother of the required invention in the necessity of the case, and may hope that the father will not be long in coming.

Under the present system, Birds are called a "Class" of Vertebrates, and are subdivided into "orders," "families," "genera," "species" and "varieties," as already sufficiently indicated. Groups intermediate to any of these may be recognized; and if so, are usually distinguished by the prefix *sub-*. Many other terms are in occasional use, as "tribe," "race," "series," "cohort," "super-family"; but those first mentioned are the best established ones among English-speaking naturalists. Their sequence is fixed, as above, from higher to lower, in relative rank.[1] With the exceptions to be presently noted, the names of any groups are arbitrary, at the will of the person who founds and designates them. The framer of a genus, or the describer of a species, calls it what he pleases, and the name he gives holds, subject to certain statutory regulations which naturalists generally agree to abide by. The exceptions are the names of families and sub-families, the former commonly being made to end in *-idæ*, the latter in *-inæ*: family *Turdidæ*; sub-family *Turdinæ*. This is a great convenience, since we always know the rank intended to be noted by these forms. The names of groups higher than species are almost invariably single words; as, order *Passeres*; but sometimes, especially in cases of intermediate groups, two words are used, one qualifying the other; as, sub-order *Passeres Acromyodi*, or oscine Passeres. A generic or sub-generic name is always a single word; these, and the names of all higher groups, invariably begin with a capital letter.

Until quite recently, the scientific name of any individual bird almost invariably consisted of two terms, generic and specific, — the name of the genus, followed by the name of the

[1] The expression "higher group," in the sense of relative rank in the taxonomic scale, will of course be distinguished from the same expression when applied to the relative rank in the scale of organization of the objects classified. An order of birds is a "higher group" than a family of birds, in the former sense, but no higher than an order of worms, in the latter sense.

species; as, *Turdus migratorius*, for the robin. This is the "binomial nomenclature" (badly so called, for "binominal" would be better); introduced by Linnæus in the middle of the last century. It was a great improvement upon the former method of giving either single arbitrary names to birds, often a mere Latin translation of their vernacular nickname, or long descriptive names of several words; probably no other single improvement in a method of nomenclature ever did so much to make the technique of nomenclature systematic. To couple the two terms at all was a great thing, the convenience of which we who never felt its want can hardly appreciate. To follow the generic by the specific term was itself of the same advantage that it is to have the Smiths and Browns of a directory entered under S and B, instead of by Johns and Jameses; besides according with the genius of the Romance languages, which commonly put the adjective after the noun. A Frenchman, for example, would say, *Bec-croisé aux ailes blanches de l'Amérique septentrionale*, or "Bill-crossed to the wings white of the America north," where we should say, "North American white-winged Cross-bill," and Linnæus would have written *Loxia leucoptera*. The binomial scheme worked so well that it came to have the authority and force of a statute, which few subsequent naturalists have been inclined, and fewer have ventured, to violate; while it became an *ex post facto* law to prior naturalists, ruling them out of court altogether, as far as the legitimacy of any of the names they had bestowed was concerned. It necessarily rested, however, or at any rate proceeded upon, the false idea of a species as a fixity. Linnæus himself experienced the inadequacy of his system to deal binomially with those lesser groups than species, commonly called "varieties," now better designated as "conspecies" or "subspecies"; and he often used a third word, separated however from the binomial name by intervention of the sign "var." or some other symbol. Thus, if he had supposed an American crossbill to be a variety of a European *Loxia leucoptera*, he might have called it *Loxia leucoptera*, *a*, *americana*. Some years ago, in treating of this subject, I urged the necessity of recognizing by name a great number of forms of our birds intermediate between nominal species, and connecting the latter by links so perfect, that our handling of "species" required thorough reconsideration. The dilemma arose, through our very intimate knowledge of the climatic and geographical variation of "species," either to discard a great number that had been described, and so ignore all the ultimate modifications of our bird-forms; or else to recognize as good species the same large number of forms that we knew shaded into each so completely that no specific character could be assigned. In the original edition of the present work (1872), I compromised the matter by reducing to the rank of varieties the nominal species that were known or believed to intergrade; and the original edition of the "Check List" (1873) distinguished such by the sign "var." intervening between the specific and the subspecific name. I subsequently determined to do away with the superfluous term "var.," and in the next edition of the Check List (1882) reverted to a purely trinomial system of naming the equivocal forms; as, *Loxia curvirostra americana*. The same system is used in the present treatise; it is found to work well, and seems likely to come into general employ, at least in this country. It is commended to the consideration of our brethren over the sea.

The Student cannot be too well assured, that no such things as species, in the old sense of the word, exist in nature, any more than have genera or families an actual existence. Indeed they cannot be, if there is any truth in the principles discussed in our earlier paragraphs. Species are simply ulterior modifications, which once were, if they be not still, inseparably linked together; and their nominal recognition is a pure convention, like that of a genus. More practically hinges upon the way we regard them than turns upon our establishment of higher groups, simply because upon the way we decide in this case depends the scientific *labelling of specimens*. If we are speaking of a robin, we do not ordinarily concern ourselves with the family or order it belongs to, but we do require a technical name for constant use. That name is compounded of its genus, species, and variety. No infallible rule can be laid

down for determining what shall be held to be a species, what a conspecies, subspecies, or variety. It is a matter of tact and experience, like the appreciation of the value of any other group in zoölogy. There is, however, a convention upon the subject, which the present workers in ornithology in this country find available; at any rate, we have no better rule to go by. We treat as "specific" any form, however little different from the next, that we do not know or believe to intergrade with that next one; between which and the next one no intermediate equivocal specimens are forthcoming, and none, consequently, are supposed to exist. This is to imply that the differentiation is accomplished, the links are lost, and the characters actually become "specific." We treat as "varietal" of each other any forms, however different in their extreme manifestation, which we know to intergrade, having the intermediate specimens before us, or which we believe with any good reason do intergrade. If the links still exist, the differentiation is still incomplete, and the characters are not specific, but only varietal, in the literal sense of these terms. In the latter case, the oldest name is retained as the specific one, and to it is appended the varietal designation: as, *Turdus migratorius propinquus*. The specific and subspecific names are preferably written with a small initial letter, even when derived from a person or place.

One other term than those just considered sometimes forms part of a bird's scientific name: this is the *subgenus*. When introduced, it always follows the generic term, in parentheses; thus, *Turdus* (*Hylocichla*) *mustelinus*. This is cumbrous, especially when there are already three terms, and is little used in this country. I have latterly discarded it altogether. There is no real difference between a subgenus and a genus, — it is a difference of slight degree merely; and modern genera have so multiplied that one can easily find a single name for any generic refinement he may wish to indulge.

It has always been customary to write after the bird's name the name of the original describer of the species, — originally and properly, as the authority or voucher for the validity of the species named. But as genera multiplied, it was often found necessary to change the generic name, the species being placed in another genus than that to which its original namer referred it. The name of the person who originated the new combination came to be generally suffixed, presumably as the authority for the validity of the classification implied. As this was to ignore the proprietorship of the original describer, it became customary to retain describer's name in parentheses and add that of the classifier; thus, *Turdus migratorius* Linnæus; *Planesticus migratorius* (Linn.) Bonaparte. The practice still prevails; it is no more objectionable than any other harmless exhibition of human vanity. The student will find it carefully carried out in my Check List, and entirely discarded in the present work.

It would take me too far to go fully into the rules of nomenclature: some few points may be noted. A proper sense of justice to the describers of new genera, species, and varieties, prompts us to preserve inviolate the names they see fit to bestow, with certain salutary provisions. Hence arises the "law of priority." The *first* name given since 1758 is to be retained and used, if it can be identified with reasonable certitude; that is, if we think we know what the giver meant by it. But it is to be discarded, and the next name in priority of time substituted, if it is "glaringly false or of express absurdity," — as calling an American bird "*africanus*," or a black one "*albus*." No generic name can be duplicated in zoölogy, and one once void for any reason cannot be revived and used in any connection. The same specific name cannot be used twice in the same genus.

The Actual Classification of Birds has undergone radical modification of late years, though the same machinery is employed for its expression. This is as would be expected, seeing how profoundly the theory of Evolution has affected our principles of classification, how completely the morphological has replaced other systems, and how steadily our knowledge of the structure of birds, and their chronological relations, has progressed. Nevertheless, the

ornithological system is still in a transition state, and the classification implied by the way North American birds are arranged in the present work must be regarded as tentative and provisional. In the original edition of the "Key," the classification was vitiated at the outset by physiological considerations,[1] and in some other respects was open to decided improvement, as I trust the present edition shows. The general arrangement is, however, much the same. The table given on a succeeding page (p. 234) will afford the student a *coup d'œil* of the groups, from subclass to subfamily, which I have been led to adopt; it represents, as far as it goes, a classification of birds at large. The principal groups, higher than families, which are absent from the North American Fauna, are: the whole of the *Ratitæ*, or Struthious birds; the *Dromæognathæ*, probably an order, embracing the South American Tinamous; the order or suborder of the Penguins of the Southern Hemisphere, *Sphenisci;* and several small superfamily groups belonging in the vicinity of the Gallinaceous and Columbine birds.

As to the primary divisions of *Aves*, it seems certain that these must be made with special reference to the extraordinary extinct forms from the Cretaceous, and to the radical difference between struthious or Ratite and Carinate Birds. The arrangement offered on p. 234 has perhaps some claims to consideration. The subclass *Carinatæ*, which includes all other existing birds, seems certainly not to be primarily divisible into a few orders, such as were in vogue but a few years ago; but to be split directly into a large number – perhaps about twenty — groups of approximately equivalent value, to be conventionally designated as orders, if we take Carinatæ as a subclass of the class *Aves*. The attempt to force birds into a few — five or six — leading divisions cannot be justified if we are to regard the taxonomic significance of a number of remarkable forms, the peculiarities of which are now well known. *Passeres* seems to be one of the most firmly established of these ordinal groups. "*Picariæ*" is one of the most unsatisfactory of all, and I have no doubt it will be abolished.

With this glance at some taxonomic principles and practices, I pass to an outline of the structure of birds, some knowledge of which is indispensable to any appreciation of ornithological definitions and descriptions. It is necessary to be brief, and I shall confine myself mainly to the consideration of those points, and the explanation of those technical terms, which the student needs to understand in order to use the present volume easily and successfully. Here, however, I will insert a tabular illustration of a sequence of zoölogical groups, from highest to lowest, under which a bird may fall: —

Kingdom, *Animalia:* Animals.
Branch, *Vertebrata:* Back-boned Animals.
Province, *Sauropsida:* Lizard-like Vertebrates.
Class, *Aves:* Birds.
Subclass, *Carinatæ:* Birds with keeled breast-bone.
Order, *Passeres:* Perching Birds.
Suborder, *Oscines:* Singing Birds.
Family, *Turdidæ:* Thrush-like Birds.
Subfamily, *Turdinæ:* True Thrushes.
Genus, *Turdus:* Typical Thrushes.
Subgenus, *Hylocichla:* Wood Thrushes.
Species, *ustulatus:* Olive-backed Thrush.
Subspecies, *aliciæ:* Alice's Thrush.

[1] In primarily dividing birds into *Aves aereæ*, *Aves terrestres*, and *Aves aquaticæ*, after Lilljeborg, I should do myself the justice to say, however, that the fact that these divisions did not rest upon morphological characters of any consequence was expressly stated (pp. 8 and 276 of the orig. ed.).

§ 3. — DEFINITIONS AND DESCRIPTIONS OF THE EXTERIOR PARTS OF BIRDS.

a. Of the Feathers, or Plumage.

Feathers are possessed only by birds, and all birds possess them. Feathers are modified scales; like scales, hair, horns, plates, sheaths, etc., they are outgrowths of the integument, or skin covering the body, and therefore belong to the class of *epidermic* (Gr. *ἐπί*, *epi*, upon; *δέρμα*, *derma*, skin), or *exoskeletal* (Gr. *ἐξ*, *ex*, out; *σκελετόν*, *skeleton*, dried; in the sense of "outer skeleton") structures. The horny coverings of the beak and feet are of the same class, but very differently developed. Besides being the most highly developed or complexly specialized, wonderfully beautiful and perfect kind of tegumentary outgrowth; besides fulfilling in a singular manner the design of covering and protecting the body; — feathers have their particular *locomotory* office: that of accomplishing the act of flying in a manner peculiar to birds. For all vertebrates, excepting birds, that progress through the air — the flying fish (*Exocœtus*) with its enlarged pectoral fins; the flying reptile (*Draco* or *Pterodactyl*) with its skinny parachute; the flying mammal (bat) with its great webbed fingers — accomplish aërial locomotion by means of tegumentary *expansions*. Birds alone fly with tegumentary *outgrowths*, or appendages. All a bird's feathers, of whatever kind, collectively constitute its *ptilosis* (Gr. *πτίλον*, *ptilon*, a feather) or PLUMAGE (Lat. *pluma*, a plume or feather).

Development of Feathers. — In a manner analogous to that of hair, a feather grows in a little pit or pouch formed by inversion of the dermal or true-skin layer of the integument, being formed in a closed follicle or shut sac consisting of an inner and outer coat separated by a layer of fine granular substance. The outer layer or "outer follicle" is composed of several thin strata of nucleated epithelial cells (cuticle cells): the inner is thicker, spongy, and filled with gelatinous fluid; a little artery and vein furnish the blood circulation, very active during the formation of feathers. The inner is the true *matrix* or mould upon which the feather is formed, evolving from the blood-supply the gelatinous material, and resolving this into cell-nuclei; the granular layer is the formative material which becomes the feather. The outer grows a little beyond the cutaneous sac that holds it, and opens at the end; from this orifice the future feather protrudes, sprouting as a little five-rayed pencil point. The process is thus graphically illustrated by Huxley: "The integument of birds is always provided with horny appendages, which result from the conversion into horn of the cells of the outer layer of the epidermis. But the majority of these appendages, which are termed 'feathers,' do not take the form of mere plates developed upon the surface of the skin, but are evolved within sacs from the surfaces of conical papillæ of the dermis. The external surface of the dermal papilla, whence a feather is to be developed, is provided upon its dorsal [upper] surface with a median groove, which becomes shallower towards the apex of the papilla. From this median groove lateral furrows proceed at an open angle, and passing round upon the under surface of the papilla, become shallower, until, in the middle line, opposite the dorsal median groove, they become obsolete. Minor grooves run at right angles to the lateral furrows. Hence the surface of the papilla has the character of a kind of mould, and if it were repeatedly dipped in such a substance as a solution of gelatine, and withdrawn to cool until its whole surface was covered with an even coat of that substance, it is clear that the gelatinous coat would be thickest at the basal or anterior end of the median groove, at the median ends of the lateral furrows, and at those ends of the minor grooves which open into them: while it would be very thin at the apices of the median and lateral grooves, and between the ends of the minor grooves. If, therefore, the hollow cone of gelatine, removed from its mould, were stretched from within; or if its thinnest parts became weak by drying; it would tend to give way, along the inferior median line, opposite the rod-like cast of the dorsal median groove and between the ends of

the casts of the lateral furrows, as well as between each of the minor grooves, and the hollow cone would expand into a flat feather-like structure with a median shaft, as a 'vane' formed of 'barbs' and 'barbules.' In point of fact, in the development of a feather such a cast of the dermal papilla is formed, though not in gelatine, but in the horny epidermic layer developed upon the mould, and, as this is thrust outward, it opens out in the manner just described. After a certain period of growth the papilla of the feather ceases to be grooved, and a continuous horny cylinder is formed, which constitutes the 'quill.'" (Introd. Classif. Anim., p. 71.)

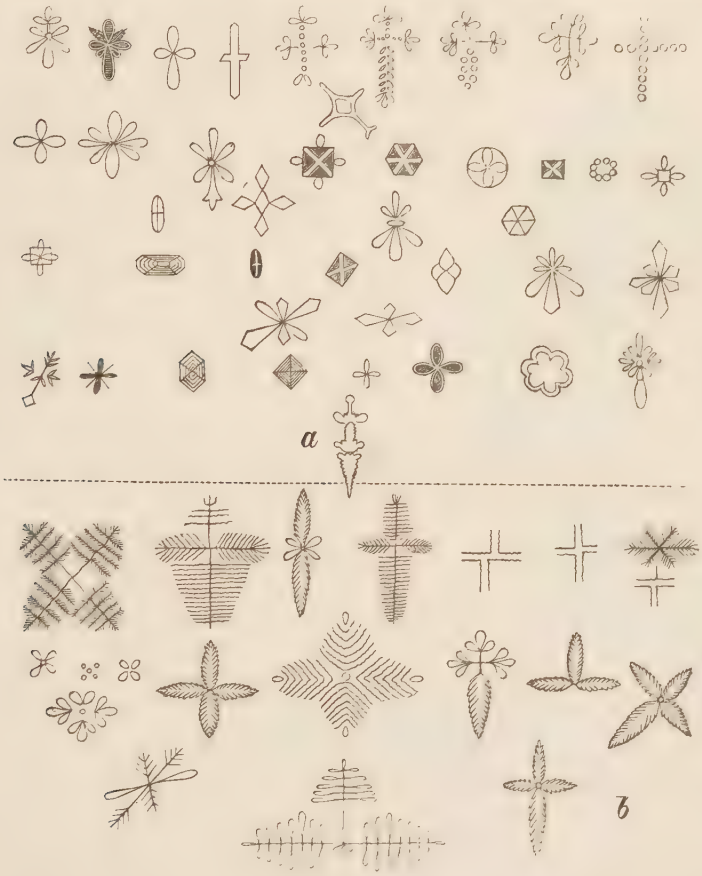


FIG. 18. — **Symmetrical Figures from Forming Feathers**; *a*, dove; *b*, turkey. — "In the summer of 1869, whilst examining the feather capsule of a nestling dove, the microscopic slide was suddenly covered with a multitude of exquisite forms. . . . The next day my German farmer climbed to the dove's nest and procured a few more pin-feathers. Some of these were cut into fine shreds, rubbed in a drop of water, and placed under the microscope. In a short period the figures of yesterday were again before me. From the cut surfaces of the portions of the pin-feathers I had placed under the lens, granules appeared to stream forth like blood, covering the microscopic slide in countless numbers. Mingled with these were numerous larger cells of a globular or oval form, having a transparent centre. These and the granules gave to the water a slightly glutinous consistency. As the fluids on the glass dried, lines at different angles shot across the slide, looking much as though an unseen camel's hair pencil had been swiftly drawn in opposite directions, sometimes at right angles, but frequently at angles more acute. Probably at the moment of transition from a fluid to a solid condition, the transparent nucleated cells assumed the form of a square, a lozenge, a starry hexagon, a cross, or any other beautiful figure which could be formed of the parts which suddenly appeared in the spherical cells, these parts seeming at first, in some instances at least, to consist of minute triangles. At the same moment the little granules moved to order, and there before the astonished gaze were diamonds such as Aladdin might have envied, in form as varied, but far more symmetrical, than the frost-work on a window pane of a winter's morning." (Miss Grace Anna Lewis, in Am. Nat., v, 1871, p. 675.)

Structure of Feathers. — A perfect feather, possessing all the parts it can have developed, consists of a main stem, shaft or scape (Lat. *scapus*, a stalk; fig. 19, *ad*), and a supplementary stem or after-shaft (*hyporhachis*; Gr. ὑπό, *hupo*, under, ῥάχις, *rhachis*, a spine or ridge; fig. 19, *b*), each bearing two webs or vanes (Lat. *vexillum*, pl. *vexilla*, a banner; fig. 19, *c, c, c*), one on either side. The whole scape is divided into two parts: one, nearest the body of the bird, the tube or barrel or "quill" proper (Lat. *calamus*, a reed), which is a hard, horny, hollow, and semi-transparent cylinder, containing a little pith in the interior; it bears no webs. One end of this quill tapers to be inserted into the skin; the other passes, at a point marked by a little pit (Lat. *umbilicus*, the navel) into the shaft proper or *rhachis*, the second part of the stem. The *rhachis* is a four-sided prism, squarish in transverse section, and tapers gradually to a fine point; it is less horny than the barrel, very elastic, opaque, and solidly pithy; it bears the vexilla. The after-shaft, when well developed, is like a duplicate in miniature of the main feather, from the stem of which it springs, at junction of calamus with rhachis, close by the umbilicus. It is generally very small compared with the main part of the feather, though quite as large in a few kinds of birds; it is entirely wanting in some groups of birds; it is never developed on the large, strong wing- and tail-feathers. The *vane* consists of a series of appressed, flat, narrowly linear or lance-linear laminæ or plates, set obliquely on the rhachis by their bases, diverging out from it at a varying open angle, ending in a free point: each such narrow, acute plate is called a *barb* (Lat. *barba*, a beard; fig. 20, *a, a*). Now if these laminæ or barbs simply lay alongside each other, like the leaves of a book, the feather would have no consistency; therefore, they are connected together; for, just as the rhachis bears its vane or series of barbs, so does each barb bear its vanes of the second order, or little vanes, called *barbules* (dimin. of *barba*; fig. 20, *b, b, c*). These are to the barbs exactly what the barbs are to the shaft, and are similarly given off from both sides of the upper edges of the barbs; they make the vane truly a *web*, that is, they so connect the barbs together that some little force is required to pull them apart. Barbules are variously shaped, but generally flat sideways, with upper and lower border at base, rapidly tapering to a slender thready end, and are long enough to reach over several barbules of the next barb, crossing the latter obliquely. All the foregoing structures are seen by the naked eye or with a simple pocket lens, but the next to be described require a microscope: they are the *barbicels* (another dimin. of *barba*), also called *cilia*, or lashes (fig. 21); and *hamuli*, or hooklets (Lat. *hamulus*, a little hook; fig. 21). These are simply a sort of fringe to the barbules, just as if the lower edge of the barbules were frayed out, and only differ from each other in that barbicels are plain hair-

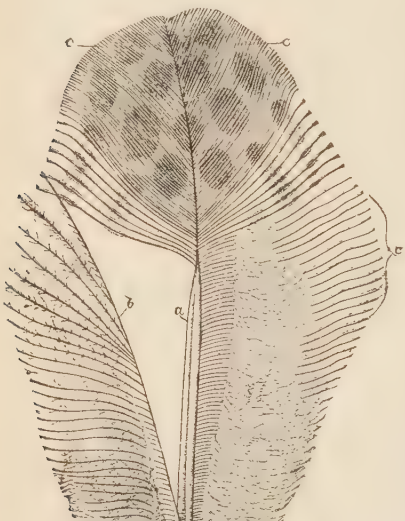


FIG. 19. — A partly pennaceous, partly plumulaceous feather, from Argus pheasant; after Nitzsch. *ad*, main stem; *d*, calamus; *a*, rhachis; *c, c, c*, vanes, cut away on left side in order not to interfere with *b*, the after-shaft, the whole of the right vane of which is likewise cut away.

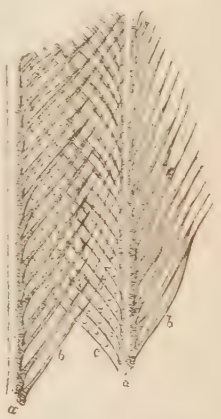


FIG. 20. — Two barbs, *a, a*, of a vane, bearing anterior, *b, b*, and posterior, *c*, barbules; enlarged; after Nitzsch.

like processes, while hamuli are hooked at the end; they are not found on all feathers, nor on all parts of some feathers. Barbicels occur on both anterior and posterior rows of barbules, though rarely on the latter; hooklets are confined to any anterior series of barbules, which, as we have seen, overlie the posterior rows, forming a diagonal mesh-work. The design of this beautiful structure is evident; the barbules are interlocked, and the whole made a web; for each hooklet of one barbule catches hold of a barbule from the next barb in front, any barbule thus holding on to as many of the barbules of the next barb as it has hooklets; while, to facilitate this interlocking, the barbules have a thickened upper edge of the right size for the hooklets to grasp. The arrangement is shown in fig. 22, where *a*, *a*, *a*, *a*, are four barbs in transverse section, viewed from the cut surfaces, with their anterior, *b*, *b*, *b*, *b*, and posterior, *c*, *c*, *c*, *c*, barbules, the former bearing the hooklets which catch over the edge of the latter.

FIG. 21. — A single barbule, bearing barbicels and hooklets; magnified; after Nitzsch.

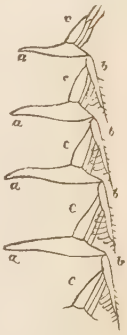


FIG. 22. — Four barbs in cross section, *a*, *a*, *a*, *a*, bearing anterior, *b*, *b*, *b*, *b*, and posterior *c*, *c*, *c*, *c*, barbules, the former bearing hooklets which catch over the latter; magnified; after Nitzsch.

Types of Feathery Structure. — But all feathers do not answer the above description. The after-shaft may be wanting, as we have seen. Hooklets may not be developed, as frequently happens. Barbicels may be few or entirely wanting. Barbules may be similarly deficient, or so defective as to be only recognized by their position and relations. Even barbs themselves may be few or lacking on one side of the shaft, or on both sides, as in certain bristly or hair-like styles of feathers. Consideration of these and other modifications of feather-structure has led to the recognition of *three* types or plans: 1. The perfectly feathery, *plumous*, or *pennaceous* (Lat. *pluma*, a plume, or *penna*, a feather fit for writing with; fig. 23), as above described. 2. The downy or *plumulaceous* (Lat. *plumula*, a little plume, a down-feather), when the stem is short and weak, with soft rhachis and barbs, with long slender thready barbules, little knotty dilatations in place of barbicels, and no hooklets. 3. The hairy, bristly, or *filo-plumaceous* (Lat. *filum*, a thread), with a very long, slender stem, and rudimentary or very small vanes composed of fine cylindrical barbs and barbules, if any, and no barbicels, knots, or hooklets. There is no abrupt definition between these types of structure; in fact, the same feather may be constructed on more than one of these plans, as in fig. 19, partly pennaceous, partly plumulaceous. All feathers are built upon one or another, or some combination, or modification, of these types; and, in all their endless diversity, may be reduced to four or five

FIG. 23. — A feather from the tail of a kingbird, *Tyrannus carolinensis*, almost entirely pennaceous; no after-shaft. From nature, by Coues.

Different Kinds of Feathers. — 1. *Contour-feathers*, *pennæ* or *plumæ* proper, have a perfect stem composed of calamus and rhachis, with vanes of pennaceous structure, at least in part, usually plumulaceous toward the base. These form the great bulk of the surface-plumage exposed to light; their beautiful tints give the bird's colors; they are the most modified in detail of all, from the fish-like scales of a penguin's wings to the glittering jewels of the humming-bird, and all the endless array of the tufts, crests, ruffs, and other ornaments of the feathered tribes; even the imperfect bristle-like feathers above mentioned may belong among

them. Another feature is, that they are usually individually moved by subcutaneous muscles, of which there may be several to one feather, passing to be attached to the sheath of the tube, inside the skin, in which the stem is inserted. These muscles may be plainly seen under the skin of a goose, and every one has observed their operation when a hen shakes herself after a sand bath, or any bird erects its top-knot. 2. *Down-feathers, plumulæ*, are characterized by a downy structure throughout. They more or less completely invest the body, but are almost always hidden beneath the contour-feathers, like padding about the bases of the latter; occasionally they come to light, as in the fleecy ruff about the neck of the condor, and then usually replace contour-feathers: they have an after-shaft, or none; and sometimes no rhachis at all, the barbs then being sessile in a tuft at the end of the quill. They often stand in a regular quincunx (∴) between four contour-feathers. 3. *Semiplumes, semiplumæ*, may be said to unite the characters of the last two, possessing the pennaceous stem of the former, and the plumulaceous vanes of the latter; they are with or without after-shaft. They stand among pennæ, as the plumulæ do, about the edges of patches of the former, or in parcels by themselves, but are always covered by contour-feathers. 4. *Filoplumes, filoplumæ*, or thread-feathers, have an extremely slender, almost invisible stem, not well distinguished into barrel and shaft, and usually no vane, unless a terminal tuft of barbs may be held for such. Long as they are, they are usually hidden by the contour-feathers, close to which they stand as accessories, one or more seeming to issue out of the very sacs in which the larger feathers are implanted. These are the nearest approach to *hairs* that birds have; they are very well shown on domestic poultry, being what a good cook finds it necessary to singe off after plucking a fowl for the table. 5. Certain down-feathers are remarkable for continuing to grow indefinitely, and with this unlimited growth is associated a continual breaking down of the ends of the barbs. Such plumulæ, from being always dusted over with dry, scurfy exfoliation, are called *powder-down;* they may be entitled to rank as a fifth kind, or *pulviplumes*. They occur in the hawk, parrot, and gallinaceous tribes, and especially in the herons and their allies. They are always present in the latter, where they may be readily seen as at least two large patches of greasy or dusty, whitish feathers, matted over the hips and on the breast. The design is unknown.

Feather Oil Gland. — Birds do not perspire, and cutaneous glands, corresponding to the sweat-glands and sebaceous follicles so common in *Mammalia*, are little known among them. But their "oil-can" is a kind of sebaceous follicle, which may be noticed here in connection with other tegumentary appendages. This is a two-lobed or rather heart-shaped gland, saddled upon the "pope's nose," at the root of the tail, and hence sometimes called the *uropygial* (Lat. *uropygium*, rump), or rump-gland. If there be no single word to name it, it may be called the *elæodochon* (Gr. ἐλαιοδόχος, *elaiodochos*, containing oil). It is composed of numerous slender tubes or follicles which secrete the greasy fluid, the ducts of which, uniting successively in larger tubes, finally open by one or more pores, commonly upon a little nipple-like elevation. Birds press out a drop of oil with the beak and dress the feathers with it, in the well-known operation called "preening." The gland is large and always present in aquatic birds, which have need of waterproof plumage; smaller in land-birds, as a rule, and wanting in some. The presence or absence of this singular structure, and whether or not it is surmounted by a particular circlet of feathers, distinguishes certain groups of birds, and has come to be made much use of in classification.

Pterylography. — Feathered Tracts and Unfeathered Spaces. — Excepting certain birds having obviously naked spaces, as about the head or feet, all would be taken to be fully feathered. So they are all *covered with feathers*, but it does not follow that feathers are everywhere implanted upon the skin. On the contrary, a uniform and continuous *pterylosis* is the rarest of all kinds of feathering; though such occurs, almost or quite perfectly, among

certain birds, as the ostrich tribe, penguins, and toucans. If we compare a bird's skin to a well-kept park, part woodland, part lawn; then where feathers grow is the woodland; where they do not grow is the lawn. The former places are called *tracts* or *pterylæ* (dimin. from Gr. πτερόν, *pteron*, a plume); the latter, *spaces* or *apteria* (Gr. *a* privative, and πτερόν); they mutually distinguish certain definite areas. Not only are the *pterylæ* and *apteria* thus definite, but their size, form, and arrangement mark whole families and even orders of birds; so that *pterylosis* becomes available, and is indeed found to be important, for purposes of classification. *Pterylography*, or the description of this matter, has been made a special study by the celebrated Nitzsch, who has laid down the general plan of pterylosis which obtains in the great majority of birds, as follows: 1. The spinal or dorsal tract (*pteryla spinalis*; fig. 24, 1), running along the middle of the bird above from the nape of the neck to the tail; subject to great variation in width, to dilation and contraction, to forking, to sending out branches, to interruption, etc. 2. The humeral tracts (*pt. humerales*; Lat. *humerus*, the shoulder, or upper arm-bone: fig. 24, 2), always present, one on each wing; they are narrow bands, running from the shoulder obliquely backward upon the upper arm-bone, parallel with the shoulder-blade.

FIG. 24. — Pterylosis of *Cypselus apus*, drawn by Coues after Nitzsch; right hand upper, left hand lower, surface. 1. spinal tract; 2. humeral; 3. femoral; 4. capital; 5. alar; 6. caudal; 7. crural; 8. ventral.

3. The femoral tracts (*pt. femorales*; Lat. *femur*, the thigh; fig. 24, 3): a similar oblique band upon the outside of each thigh, but subject to great variation. 4. The ventral tract (*pt. ventralis*; Lat. *venter*, the belly; fig. 24, 8), which forms most of the plumage on the under part of a bird, commencing at or near the throat, and continued to the vent; like the dorsal tract, it is very variable, is usually bifurcate, or forked into right or left halves, with a median apterium, is broad or narrow, branched, etc.; thus, Nitzsch enumerates *seventeen* distinct modifications! The foregoing are mostly isolated tracts, that is, bands nearly surrounded by complementary apteria; the following are, in general, continuously and uniformly feathered, and thus practically equivalent to the part of the body they represent: Thus, 5, the head tract (*pt. capitalis*; Lat. *caput*, *capitis*, head; fig. 24, 4) clothes the head, and generally runs into the beginning of both dorsal and ventral tracts. 6. The wing tract (*pt. alaris*; Lat. *ala*, wing; fig. 24, 5) represents all the feathers that grow upon the wing, excepting those of the humeral tract. 7. The tail tract (*pt. caudalis*; Lat. *cauda*, tail; fig. 24, 6) includes the tail-feathers proper and their coverts, and those about the *elæodochon*, and usually receives the termination of the dorsal, ventral, and femoral tracts. 8. The leg tract (*pt. cruralis*; Lat. *crus*, *cruris*, leg; figs. 24, 7) clothes the legs as far as these are feathered, which is generally to the heel, always below the knee, and sometimes to the toes or even the claws. — I need not enumerate the *apteria*, as these are merely the complements of the pterylæ. The

highly important special "flight-feathers" of the wings and "rudder-feathers" of the tail are to be examined beyond, in describing those members for purposes of classification.

Endysis and Ecdysis. — Putting on and off Plumage. — Newly hatched birds are covered for some time with a kind of down, entirely different from such feathers as they ultimately acquire. It is scanty, leaving much or all of the body naked, in most *altricial* birds, such as are reared by the parents in the nest (Lat. *altrix*, female nourisher); but thick and puffy in some *Altrices*, and in all *Præcoces* (Lat. *præcox*, precocious), which run about at birth. Since many birds which require to be reared in the nest are also hatched clothed, or very speedily become downy, a more exact distinction may be drawn by using the terms *ptilopædic* and *psilopædic* (Gr. πτίλον, *ptilon*, a feather; ψιλός, *psilos*, bare; and παῖς, *pais*, a child) respectively for those birds which are hatched feathered or naked; a chicken and a canary-bird are familiar examples. It is the rule, that the higher birds are born helpless and naked, requiring to be reared in the nest till their feathers grow; the reverse with lower birds, as the walking, wading, and swimming kinds; and a primary division of birds has even been proposed upon this physiological distinction. It offers, however, too many exceptions; thus, no birds are more naked and helpless at birth than young cormorants. Probably all præcocial birds are also ptilopædic and all psilopædic birds altricial; but the converse is far from holding good, many altrices, as hawks and owls, being also ptilopædic. In other words, psilopædic birds are always altricial, but ptilopædic birds may be either altricial or præcocial. In any case, true feathers are soon gained, in some days or weeks, those of the wings and tail being usually the first to sprout. The acquisition of plumage is called *endysis* (ἔνδυσις, *endusis*, putting on). The renewal of plumage is a process familiar to all, in its generalities, under the term "moult," or *ecdysis* (Gr. ἔκδυσις, *ekdusis*, putting off). Feathers are of such rapid growth, and make such a drain upon the vital energies, that we easily understand how critical are periods of the change. The first plumage is usually worn but a short time; then another more or less complete change commonly occurs. The moult is as a rule annual; and in many cases more than one moult is required before the bird attains the perfection of maturity in its feathering. It is well known how different many birds are the first year in their coloration from that afterward acquired; sometimes changes progress for several years; and some birds appear to have a period of senile decline. All such changes are necessarily connected, if not with actual moult, as is the rule, then at any rate with wear and tear and repair of the plumage. The first plumage being gained, under whatever conditions peculiar to the species, it is the general rule, that birds are subject to *single*, or *annual*, moult. This commonly occurs in the fall, when the duties of incubation are concluded, and the well-worn plumage most needs renewal. This once-a-year moult, at least, happens to nearly or quite all birds. Many, however, moult twice a year, the additional moult usually occurring in the spring-time, when a fresh nuptial suit is acquired; in such cases, the moult is said to be *double*, or *semi-annual*. Such additional moult is generally incomplete; that is, all the feathers are not shed and renewed, but more or fewer new ones are gained, with more or less loss of the old ones, if any. The most striking ornaments donned for the breeding season, as the elegant plumes of many herons, are usually worn but a brief time, being doffed in advance of the general fall moult. A few birds, as the ptarmigan (*Lagopus*), regularly have even a third or *triple* moult, shedding many of their feathers as usual in the early autumn, then changing entirely to pure white for the winter, then in spring moulting completely to assume their wedding-dress. As a rule, feathers are moulted so gradually, particularly those of the wings and tail, and so simultaneously upon right and left sides of the body, that birds are at no time deprived of the power of flight. The first *flight-feathers* acquired by young birds are usually kept till the next season; but in those that fly very early, before they are half grown, as so many gallinaceous birds do, their first weak wing-feathers are included in the general moult

which occurs to young and old in the fall. The duck tribe offer the remarkable case, that they drop their wing-quills so nearly all at once as to be for some time deprived of the power of flight. It is quite certain that many birds change the colors of their plumage remarkably, without losing or gaining any feathers, by some process which affects the texture of the feathers, such as the shedding of the barbicels and hooklets, or its pigmentation; or by such processes combined. The male of our bobolink changes from the buff dress of the female to his rich black suit without losing or gaining any feathers. It is difficult to lay down any rules of moulting for particular groups of birds, since birds very closely related differ greatly in respect to their changes of plumage, and the subject has not yet received the attention its interest and importance should claim for it. The physiological processes involved are analogous to those concerned in the shedding of the hair of mammals and the casting of the cuticle of reptiles.

Plumage-changes with Sex, Age, and Season. Aside from any consideration of the way in which plumage changes, whether by moult or otherwise, the fact remains that most birds of the same species differ more or less from one another according to certain circumstances. The dissimilarity is not only in coloration, though this is the usual and most pronounced difference, but also in the degree of development of plumes, — their size, form, and texture. Since young birds are those which have not come to sexual vigor; since breeding recurs at regular periods of the year; and since males and females usually differ in plumage, — nearly all the various dresses worn by different individuals of the same species are correlated with the conditions of the reproductive system. As the internal generative organs represent of course the essential or *primary* sexual characters, all those of the plumage just indicated may be properly classed as *secondary sexual characters*. These are of great importance, not only in practical ornithology, but as the basis of some of the soundest views that have been advanced respecting the evolution of specific characters in this class of animals. The generalizations may be made: that when the sexes are strikingly different in plumage, the young at first resemble the female; when the adults are alike, the young are different from either; when seasonal changes are great, the young resemble the fall plumage of the parents; and, further, that when the adults of two related species of the same genus are nearly alike, the young are usually intermediate, their specific characters not being fully developed. Specific characters are often to be found only in the male, the females of two related species being scarcely distinguishable, though the males may be told apart at a glance. Extraordinary developments of feathers, as to size, shape, and color, are often confined to one sex, usually the male. The more richly, extensively, or peculiarly the male is adorned, the simpler the female in comparison, as the peacock and peahen. The Wise Man of Late has formulated the several categories of secondary sexual characters, giving the following rules or classes of cases: "1. When the adult male is more beautiful or conspicuous than the adult female, the young of both sexes in their first plumage closely resemble the adult female, as with the common fowl and peacock; or, as occasionally occurs, they resemble her much more closely than they do the adult male. 2. When the adult female is more conspicuous than the adult male, as sometimes though rarely occurs [chiefly with certain birds of prey and snipe-like birds], the young of both sexes in their first plumage resemble the adult male. 3. When the adult male resembles the adult female, the young of both sexes have a peculiar first plumage of their own, as with the robin [usual]. 4. When the adult male resembles the adult female, the young of both sexes in their first plumage resemble the adults [unusual]. 5. When the adults of both sexes have a distinct winter and summer plumage, whether or not the male differs from the female, the young resemble the adults of both sexes in their winter dress, or much more rarely in their summer dress, or they resemble the females alone. Or the young may have an intermediate character; or again they may differ greatly from the adults in both their seasonal plumages. 6. In some few cases the young in their first plumage differ from each other according to sex; the young males re-

sembling more or less closely the adult males, and the young females more or less closely the adult females." — (Darwin, Desc. of Man, new ed., 1881, p. 466.)

Summary of Secondary Sexual Characters of Birds. — The temptation to give the conclusion of the whole matter in Darwin's own words, summary of his views of Sexual Selection as so important a factor in Natural Selection, need not be resisted. I therefore quote again from the work last cited, pp. 496–499.

"Most male birds are highly pugnacious during the breeding-season, and some possess weapons adapted for fighting with their rivals. But the most pugnacious and the best armed males rarely or never depend for success solely upon their power to drive away or kill their rivals, but have special means for charming the female. With some it is the power of song, or of giving forth strange cries, or instrumental music, and the males in consequence differ in their vocal organs, or in the structure of certain feathers. From the curiously diversified means for producing various sounds, we gain a high idea of the importance of this means of courtship. Many birds endeavor to charm the female by love-dances or antics, performed on the ground or in the air, and sometimes at prepared places. But ornaments of many kinds, the most brilliant tints, combs, and wattles, beautiful plumes, elongated feathers, top-knots, and so forth, are by far the commonest means. In some cases mere novelty appears to have acted as a charm. The ornaments of the males must be highly important to them, for they have been acquired in not a few cases at the cost of increased danger from enemies, and even at some loss of power in fighting with their rivals. The males of very many species do not assume their ornamental dress until they arrive at maturity, or they assume it only during the breeding season, or the tints then become more vivid. Certain ornamental appendages become enlarged, turgid, and brightly colored during the act of courtship. The males display their charms with elaborate care and to the best effect; and this is done in the presence of the females. The courtship is sometimes a prolonged affair, and many males and females congregate at an appointed place. To suppose that the females do not appreciate the beauty of the males, is to admit that their splendid decorations, all their pomp and display, are useless; and this is incredible. Birds have fine powers of discrimination, and in some few cases it can be shewn that they have a taste for the beautiful. The females, moreover, are known occasionally to exhibit a marked preference or antipathy for certain individual males.

"If it be admitted that the females prefer, or are unconsciously excited by the more beautiful males, then the males would slowly but surely be rendered more and more attractive through sexual selection. That it is this sex which has been chiefly modified, we may infer from the fact that, in almost every genus where the sexes differ, the males differ much more from one another than do the females; this is well shown in certain closely-allied representative species, in which the females can hardly be distinguished, whilst the males are quite distinct. Birds in a state of nature offer individual differences which would amply suffice for the work of sexual selection; but we have seen that they occasionally present more strongly-marked variations which recur so frequently that they would immediately be fixed, if they served to allure the female. The laws of variation must determine the nature of the initial changes and will have largely influenced the final result. The gradations, which may be observed between the males of allied species, indicate the nature of the steps through which they have passed. They explain also in the most interesting manner how certain characters have originated, such as the indented ocelli on the tail-feathers of the peacock and the ball and socket ocelli on the wing-feathers of the Argus pheasant. It is evident that the brilliant colors, top-knots, fine plumes, &c., of many male birds cannot have been acquired as a protection; indeed, they sometimes lead to danger. That they are not due to the direct and definite action of the conditions of life, we may feel assured, because the females have been exposed to the same conditions, and yet often differ from the males to an extreme degree. Although it is probable that changed conditions acting during a lengthened period have in some cases produced a definite effect on both sexes, or sometimes on one sex alone, the more important result will have been an increased tendency to vary or to present more strongly marked individual differences: and such differences will have afforded an excellent ground-work for the action of sexual selection.

"The laws of inheritance, irrespectively of selection, appear to have determined whether the characters acquired by the males for the sake of ornament, for producing various sounds, and for fighting together, have been transmitted to the males alone or to both sexes, either permanently, or periodically during certain seasons of the year. Why various characters should have been transmitted sometimes in one way and sometimes in another, is not in most cases known; but the period of variability seems often to have been the determining cause. When the two sexes have inherited all characters in common, they necessarily resemble each other; but as the successive variations may be differently transmitted, every possible gradation may be found, even within the same genus, from the closest similarity to the widest dissimilarity between the sexes. With many closely-allied species, following nearly the same habits of life, the males have come to differ from each other chiefly through the action of sexual selection; whilst the females have come to differ chiefly from partaking more or less of the characters thus acquired by the males. The effects, moreover, of the definite action of the conditions of life, will not have been masked in the females, as in the males, by the accumulation through sexual selection of strongly-pronounced colors and other ornaments. The individuals of both sexes, however affected, will have been kept at each successive period nearly uniform by the free intercrossing of many individuals.

"With species, in which the sexes differ in color, it is possible or probable that some of the successive variations often tended to be transmitted equally to both sexes; but that when this occurred the females were pre-

vented from acquiring the bright colors of the males, by the destruction which they suffered during incubation. There is no evidence that it is possible by natural selection to convert one form of transmission into another. But there would not be the least difficulty in rendering a female dull-colored, the male being still kept bright-colored, by the selection by successive variations, which were from the first limited in their transmission to the same sex. Whether the females of many species have actually been thus modified, must at present remain doubtful. When, through the law of the equal transmission of characters to both sexes, the females were rendered as conspicuously colored as the males, their instincts appear often to have been modified so that they were led to build domed or concealed nests.

"In one small and curious class of cases the characters and habits of the two sexes have been completely transposed, for the females are larger, stronger, more vociferous and brighter colored than the males. They have, also, become so quarrelsome that they often fight together for the possession of the males, like the males of other pugnacious species for the possession of the females. If, as seems probable, such females habitually drive away their rivals, and by the display of their bright colors or other charms endeavour to attract the males, we can understand how it is that they have gradually been rendered, by sexual selection and sexually-limited transmission, more beautiful than the males — the latter being left unmodified or only slightly modified.

"Whenever the law of inheritance at corresponding ages prevails, but not that of sexually-limited transmission, then if the parents vary late in life — and we know that this constantly occurs with our poultry, and occasionally with other birds — the young will be left unaffected, whilst the adults of both sexes will be modified. If both these laws of inheritance prevail and either sex varies late in life, that sex alone will be modified, the other sex and the young being unaffected. When variations in brightness or in other conspicuous characters occur early in life, as no doubt often happens, they will not be acted on through sexual selection until the period of reproduction arrives; consequently if dangerous to the young, they will be eliminated through natural selection. Thus we can understand how it is that variations arising late in life have so often been preserved for the ornamentation of the males; the females and the young being left almost unaffected, and therefore like each other. With species having a distinct summer and winter plumage, the males of which either resemble or differ from the females during both seasons or during the summer alone, the degrees and kinds of resemblance between the young and the old are exceedingly complex; and this complexity apparently depends on characters, first acquired by the males, being transmitted in various ways, as limited by age, sex, and season.

"As the young of so many species have been but little modified in color and other ornaments, we are enabled to form some judgment with respect to the plumage of their early progenitors; and we may infer that the beauty of our existing species, if we look to the whole class, has been largely increased since that period, of which the plumage gives us an indistinct record. Many birds, especially those which live much on the ground, have undoubtedly been obscurely colored for the sake of protection. In some instances the upper exposed surface of the plumage has been thus colored in both sexes, whilst the lower surface in the males alone has been variously ornamented through sexual selection. Finally, from the facts given in these four chapters [pp. 358–499 of the work in citation], we may conclude that weapons for battle, organs for producing sound, ornaments of many kinds, bright and conspicuous colors, have generally been acquired by the males through variation and sexual selection, and have been transmitted in various ways according to the several laws of inheritance — the female and the young being left comparatively but little modified."

b. The Topography of Birds.

The Contour of a Bird with the feathers on is spindle-shaped, or *fusiform* (Lat. *fusus*, a spindle), tapering at both ends; it represents two cones joined base to base at the middle or greatest girth of the body, tapering in front to the tip of the bill, behind to the end of the tail. The obvious design is easiest cleavage of air in front, and least drag or wash behind, in the act of flying. This shape is largely produced by the lay of the plumage; a naked bird presents several prominences and depressions, this irregular contour being reducible, in general terms, to two spindles or double cones. The head tapers to a point in front, at the tip of the bill, and contracts behind, toward the middle of the neck, in consequence of diminution in bulk of the muscles by which it is slung on the neck; which last is somewhat contracted or hour-glass shaped near the middle, swelling where it is slung to the body. The body is largest in front and tapers to the tail. The

Centre of Gravity is admirably preserved beneath the centre of the body, and opposite the points where it is supported by the wings. The enormous breast-muscles of a bird are among its heaviest parts, sometimes weighing, to speak roundly, as much as one-sixth of the whole bird. Now these are they that effect all the movements of the wings at the shoulder-joints, lifting as well as lowering the wings. Did these pectoral muscles pull straight, the lifters would have to be *above* the shoulder-joint; but they all lie below it, and the lifters

accomplish their office by running through pulleys to change the line of their traction. They work like men hoisting sails from the deck of a vessel; and thus, like a ship's cargo, a bird's chief weight is kept below the centre of motion. Top-heaviness is further obviated by the way in which birds with a long heavy neck and head draw these parts in upon the breast, and extend the legs behind, as is well shown by the attitude of a heron flying. The nice adjustment of balance by the variable extension of the head and feet is exactly like that produced in weighing by shifting a weight along the arm of a steel-yard; and together with the slinging of the chief weight under the wings instead of over or even between them, enables a bird to easily keep right side up in flight. The

Exterior of a Bird is divided for purposes of description into *seven* parts: — **1.** The head (Lat. *caput*); 2. The neck (Lat. *collum*); 3. The body proper, or trunk (Lat. *truncus*); 4. The bill or beak (Lat. *rostrum*); 5. The wings (Lat. pl. *alæ*); 6. The tail (Lat. *cauda*); 7. The feet (Lat. pl. *pedes*). Of these, 1, 2, 3, the head, neck, and trunk, are collectively termed the *body* (Lat. *corpus*), in distinction from 4, 5, 6, 7, which are the *members* (Lat. *membra*). The wings and feet are of course double or paired parts. The bill is strictly but a part of the head; but its manifold uses as an organ of prehension make it functionally a hand, and therefore one of the "members." The

Head has the general shape of a four-sided pyramid; of which the base is applied to the end of the neck, therefore not appearing from the exterior, and the apex of which is frustrated at the base of the bill. The uppermost side is more or less convex or vaulted, sloping in every direction; the under side is flattish and horizontal; the lateral surfaces are flattish and vertical; all similarly taper forward. The departures from any such typical shape are endless in degree and variable in kind, giving rise to numerous general descriptive terms, such as "head flattened," "head globular," but not susceptible of exact definition. The head is moulded, of course, upon the skull, corresponding in a general way to the brain-cavity of the cranium proper, both in size and shape; but it differs in several particulars. In the first place, there is the scaffolding of the jaws; secondly, large excavations to receive the eye-balls, and smaller ones for the ear-parts; thirdly, muscular masses overlying the bone; and lastly, in some birds, large hollow spaces in the bone between the inner and outer tables or plates of the cranial walls. Each side of the head presents two openings for the *eye* (Lat. *oculus*) and *ear* (Lat. *auris*), the position of which is variable, both absolutely and in relation to each other. But in the vast majority of birds, the eye is strictly lateral in situation, and near the middle of the side of the head; while the ear is behind and a little below the eye, near the articulation of the lower jaw. But the shape of the skull of owls is such, that the eyes are directed forward, and such birds are said to have "eyes anterior." Owls also have enormous outer ears, in some cases provided with a movable flap or conch, closing upon the opening like the lid of a box; and in many cases their ear-parts, and some of the cranium itself, is unsymmetrical. In most birds the ear-opening is quite small, and only covered by modified feathers. In the woodcock and snipe, owing to the way the brain-box is tilted up, the ears are below and not behind the eyes. The *mouth* (Lat. *os*, gen. *oris*) is always a fissure across the front of the head. The cleavage varies, both in extent and direction; the latter is usually horizontal, or nearly so, but may trend much downward; the former varies from a minimum, in which the cleft does not reach back of the horny part of the bill, as in a snipe, to the maximum seen in fissure-billed birds like the swifts and goatsuckers, which gape almost from ear to ear. There are no other openings in the head proper, for the nostrils are always in the bill. The

Neck, in effect, is a simple cylinder, rendered somewhat hour-glass-shaped, as above said. It consists of a movable chain of bones, the *cervical vertebræ* (Lat. *cervix*, the neck; *verto*, I

turn) enveloped in muscle, along which in front lie the gullet (Lat. *œsophagus*) and windpipe (Lat. *trachea*), with associate blood-vessels, nerves, etc. Its length is very variable, as is the number of its bones, the latter ranging from 8 to about 26. Bearing as it does the head, with the *bill*, which is the true *hand* of a bird, the neck is extremely flexible, to permit the necessarily varied movements of this handy member. Its least length may be said to be that which allows the point of a bird's beak to reach the oil-gland on the rump; its greatest length sometimes exceeds that of the body and tail together, as in the case of a swan, crane, or heron. The length is usually in direct proportion to that of the legs, in obvious design of allowing the beak to touch the ground easily to pick up food. The neck is habitually carried in a double curve, like an open S or italic *f*, the lower belly of the curve, convex forward, fitting in between the forks of the merry-thought (Lat. *furculum*), the upper curve holding the head horizontal at the same time. This "sigmoid flexure" (*sigma*, Greek S), highly characteristic of the bird's neck, is produced by the saddle-shaping of the articular surfaces of the several bones. The mechanical arrangement is such, that the sigma may be easily bent till the upper end (head) rests on the lower convexity, or as easily straightened to a right line; but little if any further deviation in opposite curvature is permitted. As a generalization, the neck may be called relatively longest in wading birds, as herons, cranes, ibises, etc.; shortest in perching birds, as the great majority of small *Insessores;* intermediate in swimming birds. But many swimmers, as swans and cormorants, have extremely long necks; and some waders, as plovers, have very short ones. A long neck is a rarity among the higher birds (above the *Gallinæ*), in most of which the head seems to nestle upon the shoulders. The longer the neck, the more sinuous and flexible is it likely to be. Anatomically, the neck ends before at the articulation of the *atlas* (first cervical vertebra) with the skull, and behind at the first vertebra which bears free jointed ribs reaching the sternum. (See also p. 133, *Anatomy.*) The shape of the

Body proper, or Trunk, is obviously referable to that of the egg; it is *ovate* (Lat. *ovum*, an egg; whence *oval*, the plane figure represented by the middle lengthwise section of an egg; *ovate* or *ovoid*, the solid figure). The swelling of the breast represents the greatest diameter of the egg, usually near the larger end. But the ovoid is never perfectly expressed, and departures from the figure are numberless. In general, the higher perching birds have the body nearly of the ovate shape; among waders, the figure is usually *compressed*, or flattened vertically, as is well seen in the herons, and still better in the rails, where the lateral narrowing is at an extreme; among swimmers, the body is always more or less *depressed*, or flattened horizontally, and especially underneath, that the birds may rest on the water with more stability, as well shown by a duck or diver. Anatomically the body begins with the foremost *dorsal vertebræ*, or those that bear true ribs; laterally, it ceases quite definitely at the shoulder-joints, the whole of the fore limb being outside the general content of the trunk; behind, in the middle line, it includes everything, only the tail-*feathers* themselves being beyond it; behind and laterally, it includes more or less of the legs, for these are generally buried in the common integument of the body to the knee-joint, nearly or quite so, and sometimes to the heel-joint; though more strictly the trunk should be limited by the hip-joint. The rib-bearing part of the back-bone, the ribs themselves, and the greatly enlarged breast-bone (Lat. *sternum*) compose the cavity of the chest (Lat. *thorax*). Upon this bony box, which contains the heart and lungs and some other viscera, are saddled on each side the bones of the *shoulder-girdle* or *scapular-arch*, namely, the shoulder-blades (Lat. *scapula*), the *coracoids*, and the collar-bones (Lat. *clavicula*), all three of which come together at the shoulder-joint. The thoracic cavity is not separated by any partition or *diaphragm* from that of the belly (Lat. *abdomen*), which with the *pelvis*, or basin, contains the digestive, urinary, and genital organs. The pelvis is composed, in dorsal mid-line, of so many of the vertebræ (*dorso-lumbar, sacral* proper, and *urosacral*, as become immovably joined to one another, and laterally of the confluent haunch-

bones. The numerous *anchylosed* (or confluent) vertebræ compose the *sacrum*. The haunch-bones or *ossa innominata* consist on each side of three bones, *ilium*, *ischium*, and *pubis*, in adult life more or less perfectly anchylosed. Where they all three come together is the hip-joint. The remaining bones, usually included among those of the body proper, are the *coccygeal* or caudal vertebræ. (For anatomical detail see beyond, under *Osteology*, etc.)

Topography of the Body. — Besides being thus divided into head, neck, trunk, and members, the exterior of the body is further subdivided or mapped out into *regions* for the purposes of description. It is necessary for the student to become familiar with the "topography" of a bird, as this kind of mapping out may be called, for the names of the regions or outer areas are incessantly used in ordinary descriptive ornithology. Many more names have been applied than are in common use; I shall try to define and explain all those which are usually employed, beginning with the parts of the *body*, and ending with those of the *members*.

1. *REGIONS OF THE BODY.*

Upper and Under Parts. — Draw a line from the corner of the mouth along the side of the head and neck to and through the shoulder-joint and thence along the side of the body to the root of the tail; all above this line, including the upper surfaces of the wings and tail, are *upper parts;* all below it, including under surfaces of wings and tail, are *under parts;* for which the short words "above" and "below" often stand. The distinction is purely arbitrary, but so convenient as to be practically indispensable. It will be seen how an otherwise lengthy description, enumerating parts that lie over or under the "lateral line" can be put in so few words as, for example, "above, green; below, yellow." Many birds colors have some such simple general distribution. These parts are also the *dorsal* (Lat. *dorsum*, back) and *ventral* (Lat. *venter*, belly) surfaces or aspects. The upper parts of the body proper, or trunk, have also received the general name of *notæum* (Gr. *νῶτος*, *notos*, back); the under parts, similarly restricted, that of *gastræum* (Gr. *γαστήρ*, *gaster*, belly): but these terms are not much used now. These two are *never naked*, while both head and neck may be variously bare of feathers. The only exception is the transient condition of certain birds during incubation, when, like the eider duck, they pull off feathers to furnish the nest, or when the plumage, as usually happens, wears off. The gastræum is rarely ornamented with feathers different in texture or structure from those of the plumage at large; but such a case is furnished by our Lewis's woodpecker (*Asyndesmus torquatus*). The notæum, on the contrary, is often the seat of extraordinary development of feathers, either in size, shape, or texture, or all three of these qualities; as the singularly elegant dorsal plumes of many herons. Individual feathers of the notæum are generally pennaceous, and for the most part straight and lanceolate; and as a whole lie smoothly shingled or *imbricated*. The ventral feathers are usually more largely plumulaceous, and less flat and imbricated, but even more compact, that is thicker, than those of the upper parts; especially among water birds, where they are more or less curly, and very thick set. There are subdivisions of the

Notæum. — Beginning where the neck ends, and ending where the tail-coverts begin (see fig. 25, 12), this part of a bird is subdivided into *back* (Lat. *dorsum;* fig. 25, 11) and *rump* (Lat. *uropygium;* fig. 25, 13). These are in direct continuation of each other, and their limits are not precisely defined; the feathers of both are of the *pteryla dorsalis*. In general, we should call the anterior two-thirds or three-fourths of notæum "back," and the rest "rump." With the former are generally included the scapular or shoulder-feathers, *scapulars* or *scapularies;* these are they that grow on the *pterylæ humerales*. The region of notæum they represent is called *scapulare* (Lat. *scapula*, shoulder-blade), and that part of notæum strictly

between them is called the *interscapulare* (fig. 25, 10); it is often marked, as in the chipping sparrow, with streaks or some other distinctive coloration. A part of dorsum, lying between interscapulare and uropygium, is sometimes recognized as the "lower back" (Lat. *tergum*); but this distinction is not practically useful. To uropygium probably also belong the feathers of the *pterylæ femorales*, or at any rate these are commonly included with the rump in descriptions; but they more properly represent the *flanks* (Lat. *ilia*, or *hypochondria*); that is, sides of the rump. They are sometimes the seat of largely developed or otherwise peculiarly modified feathers, as the snowy flank plumes of the white-bellied swift (*Panyptila saxatilis*) or violet-green swallow (*Tachycineta thalassina*), which meet over the rump. The whole of notæum, taken together with the upper surfaces of the wings, is called the *mantle* (Lat. *stragulum*, a cloak); often a convenient term, as in describing gulls and terns for example. In like manner, the

FIG. 25 — Topography of a Bird. 1, forehead (*frons*). 2, lore. 3, circumocular region. 4, crown (*vertex*). 5, eye. 6, hind head (*occiput*). 7, nape (*nucha*). 8, hind neck (*cervix*). 9, side of neck. 10, interscapular region. 11, *dorsum*, or back proper, including 10. 12, *notæum*, or upper part of body proper, including 10, 11, and 13. 13, rump (*uropygium*). 14, upper tail-coverts. 15, tail. 16, under tail-coverts (*crissum*). 17, tarsus. 18, abdomen. 19, hind toe (*hallux*). 20, *gastræum*, including 18 and 24. 21, outer or fourth toe. 22, middle or third toe. 23, side of the body. 24, breast (*pectus*). 25, primaries. 26, secondaries. 27, tertiaries; nos. 25, 26, 27 are all *remiges*. 28, primary coverts. 29, *alula*, or bastard wing. 30, greater coverts. 31, median coverts. 32, lesser coverts. 33, the "throat," including 34, 37, 38. 34, *jugulum* or lower throat. 35, auriculars. 36, malar region. 37, *gula*, or middle throat. 38, *mentum*, or chin. 39, angle of commissure, or corner of mouth. 40, ramus of under mandible. 41, side of under mandible. 42, *gonys*. 43, *apex*, or tip of bill. 44, *tomia*, or cutting edges of the bill. 45, *culmen*, or ridge of upper mandible, corresponding to gonys. 46, side of upper mandible. 47, nostril. 48 passes across the bill a little in front of its *base*.

Gastræum is subdivided into regions, called, in general terms, *breast* (Lat. *pectus*; fig. 25, 24), *belly* (Lat. *abdomen*; fig. 25, 18), and *sides of the body* (Lat. *pleura*; fig. 25, 23). The "sides" or pleuræ belong really as much to the dorsal as to the ventral aspects of a bird's body; but in consequence of the underneath-freighted shape, the line we drew passes so high up along them, that they are almost entirely given over to gastræum. The *breast* begins over

the merry-thought where jugulum (see beyond) ends: on either hand, it slopes up to "sides"; behind, its extension is indefinite. It should properly reach as far as the breast-bone does, to the limit of the thorax: but in many birds this would leave almost nothing for abdomen, and the limit would moreover fluctuate with almost every family of birds, the sternum being so variable in length. Practically, therefore, without reference to the breast-bone, "breast" or *pectus* is restricted to the *swelling* anterior part of gastræum, which we call belly or *abdomen* as soon as it begins to straighten out and flatten. Abdomen, like pectus, rounds up on either hand into sides: behind, it ends definitely in a transverse line passing across the anus. It has been unnecessarily divided into *epigastrium* or "pit of the stomach," and *venter* or lower belly; but these terms are rarely used. (*Crissum* is a word constantly used for some indefinite region immediately about the vent: sometimes meaning the flanks, sometimes the vent-feathers or under tail-coverts proper; I refer to it again in connection with these last.) Though these boundaries seem fluctuating and not perfectly satisfactory, a little practice will enable the student to appreciate their proper use in descriptions, and to employ them himself with sufficient accuracy. The adjectival terms are respectively *pectoral*, *abdominal*, and *lateral*. The anterior continuation of the trunk, or the

Neck (Lat. *collum*) is likewise subdivided into regions. Its lateral aspects, except in those birds that have lateral neck-tracts of feathers, are formed by the meeting over its sides of the feathers that grow on the dorsal and ventral pterylæ, the skin being usually not planted with feathers. Partly on this account, perhaps, a distinctively named region is not often expressed; we say simply "sides of the neck," or "neck laterally" (*parauchenia*, fig. 25, 9). The neck behind, or the dorsal (upper) aspect, is divided into two portions: a lower, the "hind neck" proper, or "scruff of the neck" (Lat. *cervix*; fig. 25, 8), next to the back; and an upper, or "nape of the neck" (Lat. *nucha*; fig. 25, 7), adjoining the hind head. These are otherwise respectively known as the *cervical* and *nuchal region*; and, in speaking of both together, we usually say "the neck behind." The front of the neck has been needlessly subdivided, and these subregions vary with almost every writer. It suffices to call it *throat* (Lat. *gula*, fig. 25, 37, or *jugulum*, 34); remembering that the *jugular* portion is lowermost, vanishing in breast, and the *gular* uppermost, running into chin along the under surface of the head. *Guttur* is a term sometimes used to include gula and jugulum together: it is simply equivalent to "throat," as just defined; the adjective is *guttural*. Though generally covered with feathers, the neck, unlike the trunk, is frequently partly naked. When naked *behind*, it is usually cervix that is bare, as so characteristically occurs in herons, from interruption of the forward extension of the pteryla spinalis. Nucha is seldom if ever naked, except as an extension of general bald-headedness. Gula is similarly naked from above downwards, as conspicuously illustrated in the order *Steganopodes*, comprising the pelicans, cormorants, etc., which have a bare gular pouch; and as seen in many vultures, whose baldness extends over nucha and gula, and even all around the neck, as in the condor, whose nakedness ends with so singular a collar of close-set, downy feathers. The lower throat or jugulum becomes naked in a few birds, in which a distended crop or craw protrudes, pushing apart feathers of two branches of the *pteryla ventralis* as these ascend the neck. The rule is, that the neck is not the seat of enlarged or otherwise highly developed feathers, which might restrict the requisite freedom of its motion: but there are some signal exceptions, among which may be instanced the grouse family. The ruffed grouse has a singular umbrella-like tuft on each side of the neck: the pinnated grouse has still more curious winglets in the same situation, covering bare distensible skin: the sharp-tailed grouse is in somewhat similar but less pronounced case; while the cock of the plains has some extraordinary jugular developments of feathers in connection with his subcutaneous tympanum. Cervix proper almost never has modified feathers, but often a transverse coloration different from that of the rest of the upper parts; when conspicuous, this

is called "cervical collar," to distinguish it from the guttural or jugular "collars" or rings of color. Nucha is frequently similarly marked with a "nuchal band;" often special developments there take the form of *lengthening* of the feathers, and we have a "nuchal crest." More particularly in birds of largely variegated colors, guttur and jugulum are marked *lengthwise* with stripes and streaks, of which those on the sides are apt to be different from those along the middle line in front. Jugulum occasionally has lengthened feathers, as in many herons. Higher up, the neck in front may have variously lengthened or otherwise modified feathers. Conspicuous among these are the *ruffs*, or tippets, of some birds, especially of the grebe family (Podicipedidæ), and, above all our other birds, of the male ruff (*Machetes pugnax*). But these, and a few other modifications of the feathers of the upper neck, are more conveniently considered with those of the

Head. — Though smaller than any of the areas already considered, the head has been more minutely mapped out, and much detail is required by the number and importance of its recognizable parts or regions. Without intending to mention all that have been named, I describe all needed to be known for any practical purposes.

"Top of the head" is a collective term for all the upper surface, from base of bill to nape, and laterally to about the level of the upper border of the eyes; this is the *pilcum* or "cap" (fig. 25, 1, 4, 6); it is divided into three portions. The *forehead*, or frontal region, or simply "the front" (Lat. *frons;* fig. 25, 1), includes all that slopes upward from the bill, — generally to about opposite the anterior border of the eyes. *Middle head* or crown (Lat. *corona*) or *vertex* (Lat., fig. 25, 1), includes the top of the head proper, or highest part, from the rise of the forehead to the fall of the hind-head towards nucha. This slope is the *hind-head*, or *occiput* (Lat., fig. 25, 6). The lateral border of all three constitutes the superciliary line, that is, the line over the eye (Lat. *super*, over; *cilia*, little hairs, especially of the brows). "Crown" is often used as the same thing as pileum. The adjectives of the several words are *frontal, coronal* or *vertical*, and *occipital:* pileum has none in use, coronal being said instead.

"Side of the head" is a general term defining itself; it presents for consideration several regions. The *orbital* or *circumorbital* region, or simply the *orbit* (Lat. *orbis*, an orb, here the socket of the eyeball; fig. 25, 3), is a small space forming a ring around the eye. It includes the eye, and especially the eyelids (Lat. *palpebræ*). The points where these meet, in front and behind, respectively, are the *anterior canthus* and *posterior canthus* (Gr. κανθός, *kanthos*, Lat. *canthus*, a tire). The orbital region is subdivided into *supra-orbital, infra-orbital, ante-orbital*, and *post-orbital*, according as its upper, under, front, or back portion is desired to be specially designated. The situation of the orbit varies much in different groups of birds; it is generally midway, as said above, but may be higher or lower, jammed on toward the bill, or pushed far up and back, as strikingly shown in the woodcock. In owls, the orbital region is exaggerated into a great disc of radiating feathers, conferring a peculiar physiognomy. The *aural* or *auricular* (Lat. *auris*, or *auriculum*, ear; fig. 25, 35) region lies about the external opening of the ear, or *meatus auditorius;* its position varies in heads of different shapes, but it nearly always lies behind and a little below the eye. Wherever located, it may be recognized at a glance, by the peculiar texture of the feathers (the *auriculars*) which overlie the meatus. Doubtless to offer least obstacle to sound, these are a parcel of loose-webbed little plumes, which may be collectively raised and turned forward, exposing the orifice of the ear; they are extremely large and notable in those owls which have complicated external ear parts, and in such they form part of the great facial disc. The term "temporal region" or "temple" is not often used in ornithology, not being well distinguished from the post-orbital space between eye and ear, and having nothing special about it. At the lowermost back corner of the side of the head, generally just behind and below the ear, may be seen or felt a hard protuberance; it is the sharpest corner-stone of the head, being the place where the lower jaw hinges upon the

skull. This is called the "angle of the jaw;" it is a good landmark, which must by no means be confused with the "angle of the mouth," where the horny parts of the beak come together. The *lore* (Lat. *lorum*, a strap, or bridle; hence, place where the cheek-strap passes; fig. 25, 2) includes pretty much all the space between the eye and the side of the base of the upper mandible; a considerable part of it is simply ante-orbital. Thus we say of a hawk, "lores bristly;" and examination of a bird of that kind will show how large a space is covered by the term. Lore, however, should properly be restricted to a narrow line between the eye and bill in the direction of the nostrils. It is excellently shown in the heron and grebe families, where "naked lores" is a distinctive character. The lore is an important place, not only from being thus marked in many birds, but from being frequently the seat of specially modified or specially colored feathers. The rest of the side of the head, including the space between angle of jaw and bill, has the name of *cheek* (Lat. *gena*, first eyelid, then, and generally, the prominence under the eye formed by the cheek-bones; fig. 25, 36). It is bounded above by loral, infra-orbital, and auricular regions; below, by a more or less straight line, representing the lower edge of the bony prong of the under mandible. It is cleft in front for a varying distance by the backward extension of the gape of the mouth; above this gape is more properly *gena*, or *malar region* (Lat. *mala*, upper jaw) in strictness; below it is *jaw* (*maxilla*), or rather "side of the jaw." The lower edge of the jaw definitely separates the side of the head from the "under surface" of the head; properly bounded behind by an imaginary line drawn straight across from one angle of the jaw to the other, and running forward to a point between the forks of the under mandible. As already hinted, "throat" (*gula;* fig. 25, 37) extends upward and forward into this space without obvious dividing line; it runs into *chin* (Lat. *mentum;* fig. 25, 38), of which it is only to be said, that it is the (varying in extent) anterior part of the under surface of the head. Anteriorly, it may be conveniently marked off, opposite the point where the feathers end on the side of the lower jaw, from the feathery space (when any) *between* the branches of the upper mandible itself; this latter is called the *interramal* space (Lat. *inter*, between, *ramus*, fork).

The head is so often marked lengthwise with different colors, apt to take such definite position, that these lines have received special names. *Median vertical line* is one along the middle of pileum, from base of bill to nucha; *lateral vertical lines* bound it on either side. *Supraciliary line* has already been noticed; below it runs the *lateral stripe;* that part of it before the eye, is loral or ante-orbital; behind the eye, post-orbital; when these are continuous through the eye, they form a *trans-ocular* (Lat. *trans*, across; *oculus*, eye) *line;* below this is *malar line*, or cheek-stripe (Lat. *frenum*, a bridle); below this, on the under jaw, *maxillary* or *submaxillary line;* in the middle below, *mental* or *gular lines*.

No part of the body has so variable a ptilosis as the head. In the great majority of birds it is wholly and densely feathered; it ranges from this to wholly naked; but nakedness, it should be observed, means only absence of perfect feathers, for most birds with unfeathered heads have a hair-like growth of filoplumes on the skin. Our samples of naked-headed birds are the turkey, the vultures, the cranes, and some of the heron tribe, as ibises. Associated with more or less complete "baldness," is the frequent presence of various fleshy outgrowths, as *combs*, *wattles*, *caruncles* (warty excrescences), *lobes*, and *flaps* of all sorts, even to enumerate which would exceed our limits. The parts of the barn-yard cock exemplify the whole; among North American birds they are very rare, being confined, in evident development at any rate, to the wild turkey. Sometimes *horny plates* take the place of feathers on part of the head; as the frontal shields of the coots and gallinules. A very common form of head-nakedness marks one whole order of birds, the *Steganopodes*, which have mentum and more or less of gula naked, and transformed into a sort of pouch, extremely developed in the pelicans, and well seen in the cormorants. The next commonest is definite bareness of the lores, as in all herons and grebes; in the former including the whole circum-orbital region. A little orbital space is

bare in many birds, as the vulturine hawks, and some pigeons; species of grouse have a bare warty supra-orbital space. Among water-birds particularly, more or less of the interramal space is almost always unfeathered; the nakedness always proceeds from before backwards. With the rare exceptions of a narrow frontal line, and a little space about the angle of the mouth, no other special parts of the head than those above given are naked in any North American bird, unless associated with general baldness.

The opposite condition, that of redundant feathering, gives rise to all the various crests (Lat., pl. *cristæ*) that form such striking ornaments of many birds. Crests proper belong to the top of the head, but may be also held to include those growths on its side; these together being called crests in distinction to the ruffs, ruffles, beard, etc., of gula or mentum. Crests may be divided into two kinds: 1, where the feathers are simply lengthened or otherwise enlarged; and 2, where the texture, and sometimes even the structure, is altered. Nearly all birds possess the power of moving and elevating the feathers on the head, simulating a slight crest in moments of excitement. The general form of a crest is a full, soft elongation of the coronal feathers collectively; when perfect, such a crest is *globular*, as in the genus *Pyrocephalus*; generally, however, the feathers lengthen on the occiput more than on the vertex or front, and this gives us the simplest and commonest form. Such crests, when more particularly occipital, are usually connected with lengthening of nuchal feathers, and are likely to be of a thin, pointed shape, as well shown in the kingfisher. Coronal or vertical crests proper are apt to be rather different in coloration than in specially marked elongation of the feathers; they are perfectly illustrated in the king-bird, and other species of the genus *Tyrannus*. Frontal crests are the most elegant of all; they generally rise as a pyramid from the forehead, as excellently shown in the blue jay, cardinal bird, tufted titmouse, and others. All the foregoing crests are generally single, but sometimes double; as shown in the two lateral occipital tufts of the "horned" lark, in all the tufted or "horned" owls, and in a few cormorants. Lateral crests are, of course, always double, one on each side of the head; they are of various shapes, but need not be particularized here, especially since they mostly belong to the second class of crests, — those consisting of texturally modified feathers. It is a general, though not exclusive, character of these last that they are *temporary;* while the other kind is only changed with the general moult, these are assumed for a short period only, the breeding season; and, furthermore, they are often distinctive of *sex*. Occurring on the top of the head, they furnish the most remarkable ornaments of birds. I need only instance the elegant helmet-like plumes of the partridges of the genus *Lophortyx;* the graceful flowing train of *Oreortyx;* the somewhat similar plumes of the night and other herons. The majority of the cormorants, and many of the auks, possess lateral plumes of similar description; these, and those of the herons, are probably — in most cases certainly — *deciduous;* while those of the partridges above mentioned last as long as the general plumage. These lateral plumes, in many birds, especially among grebes, are associated with, and, in fact, coalesce with, the ruffs, which are singular lengthening and modifying in different ways of feathers of auriculars, genæ and gula; and are almost always temporary. *Beards*, or special lengthening of the mental feathers alone, are comparatively rare; we have no good example among our birds, but a European vulture, *Gypaëtus barbatus*, is one. The feathers sometimes become *scaly* (*squamous*), forming, for instance, the exquisite gorgelets or frontlets of humming-birds. They are often *bristly* (*setaceous*), as about the lores of nearly all hawks, the forehead of the dabchick, meadow-lark, etc. A particular set of bristles, which grow in single series along the gape of many birds, are called *rictal bristles* or *vibrissæ*. These occur in greater or less development in most small insectivorous birds; they are large and stiff and highly characteristic of the family *Tyrannidæ*, or flycatchers; while in some of the goatsuckers (*Caprimulgidæ*) they are prodigiously long, and in one species of that family (*Antrostomus carolinensis*) they have lateral filaments. While usually all the unlengthened head-feathers point backward, they are sometimes *erect*, forming

a velvety pile, or they may radiate in a circle from a given point, as from the eye in most owls, where they form a *disc*.

In the foregoing paragraph I only mention a few styles of crests, chiefly needed to be known in the study of our birds; but should add that there are many others, with endless modifications, among exotic birds; to these, however, I cannot even allude by name. Peculiarities of nasal feathers, and others around the base of the bill, are noticed below. Forms of crests are illustrated by many of the figures given *passim* in the present work.

2. OF THE MEMBERS: THEIR PARTS AND ORGANS.

I. THE BILL.

The Bill (Lat. *rostrum*) is hand and mouth in one: the instrument of *prehension*. As hand, it takes, holds, and carries food or other substances, and in many instances, *feels;* as mouth, it tears, cuts, or crushes, according to the nature of the substances taken; assuming the functions of both lips and teeth, neither of which do any recent birds possess. An organ thus essential to the prime functions of birds, one directly related to their various modes of life, is of much consequence in a taxonomic point of view; yet its structural modifications are so various and so variously interrelated, that it is more important in framing genera than families or orders; more *constant* characters must be employed for the higher groups. The general shape of the bill is referable to the *cone;* it is the anterior part of the general cone that we have seen to reach from its point to the base of the skull. This shape confers the greatest strength combined with the greatest delicacy; the end is fine to apprehend the smallest objects, while the base is stout to manipulate the largest. But in no bird is the cone expressed with entire precision; and, in most, the departure from this figure is great. The bill always consists of two, the upper and the lower

Mandibles (fig. 26), which lie, as their names indicate, above and below, and are separated by a horizontal fissure, — the mouth. Each mandible always consists of certain projecting skull-bones, sheathed with more or less *horny* integument in lieu of true skin. The frame-work of the Upper Mandible is (chiefly) a bone called the *intermaxillary*, or better, in this case, the *premaxillary*. In general, this is a three-pronged or tripodal bone running to a point in front, with the uppermost prong, or foot, implanted upon the forehead, and the other two, lower and horizontal, running into the sides of the front of the skull. The scaffold of the Under Mandible is a compound bone called *inferior maxillary;* it is U- or V-shaped, with the point or convexity in front, and the prongs running to either side of the base of the skull behind, to be there movably hinged. These two bones, with certain accessory bones of the upper mandible, as the *palate* bones, etc., together with the horny investment, constitute the JAWS. *Both* jaws, in birds, are *movable;* the under, by the joint just mentioned; the upper, either by a joint at, or by the elasticity of the bones of, the forehead; it is moved by a singular muscular and bony apparatus in the palate, further notice of which is given beyond, under head of Anatomy (Osteology). The motion of the upper mandible is freest and most extensive in the parrot tribe, where both fronto-maxillary and palato-maxillary sutures exist. When closed, the jaws meet and fit along their apposed edges or surfaces, in the same manner and for the same purposes as the lips and teeth of man or other vertebrate animals. All bills, thus similarly constituted, have been divided into

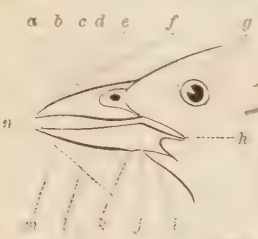


FIG. 26. — Parts of a Bill. *a*, side of upper mandible; *b*, culmen; *c*, nasal fossa; *d*, nostril; *e*, see below; *f*, gape, or whole commissural line; *g*, rictus; *h*, commissural point or angle of the mouth; *i*, ramus of under jaw; *j*, tomia of under mandible (the reference lines *g* should have been drawn to indicate the corresponding tomia of upper mandible); *k*, angle of gonys; *l*, gonys; *m*, side of under mandible; *n*, tips of mandibles.

Four Classes, representing as many ways in which the two mandibles close upon each other at the end. 1. The *epignathous* (Gr. *ἐπί, epi*, upon, *γνάθος, gnathos*, jaw) way, plan, or type, in which the upper mandible is longer than the under, and its tip is evidently bent down over the tip of the lower. 2. The *hypognathous* (Gr. *ὑπό, hupo*, under), in which the lower mandible is longer than the other. 3. The *paragnathous* (Gr. *παρά, para*, at or by), in which both are of about equal length, and neither is evidently bent over the other. 4. The *metagnathous* (Gr. *μετά, meta*, with, beside, etc.), in which the points of the mandibles cross each other. The second and fourth of these are extremely rare; they are exemplified, respectively, by the skimmer and the cross-bill (genera *Rhynchops* and *Loxia*). The first is common, occurring throughout the birds of prey, the parrots, and among the petrels, gulls, etc., etc. The great majority of birds exhibit the third; and, among them, there is such evident gradation into epignathism, that it is necessary to restrict the latter to its complete development, exhibited in the intermaxillary bone divested of its horny sheath, which often, as among fly-catchers, etc., forms a little overhanging point, but does not constitute epignathism. These classes, it should be added, though always applicable, and very convenient in descriptions, are purely arbitrary, that is, they by no means correspond to any four large groups of birds; but, on the contrary, usually only mark families and the subdivisions of families; and the four types may be seen in contiguous genera. The general shape of the bill has also furnished

Other Classes, for many years used as a large basis for ornithological classification, even for the establishment of orders; but which the progress of the science has shown to be merely as convenient as, and only less arbitrary than, the foregoing. The principal of these are represented by the following types: A, among land birds. 1. The *fissirostral* (Lat. *fissus*, cleft, and *rostrum*), or cleft, in which the bill is small, *short*, and with a very large gap running down the side of the head; as in the swallow, chimney-swift, whippoorwill. 2. The *tenuirostral* (Lat. *tenuis*, slender), or slender, in which the bill is small, *long*, and with a short cleft; as in the humming-bird, creeper, nuthatch. 3. The *dentirostral* (Lat. *dens*, a tooth), or toothed, in which, with a various general shape, there is present a nick, tooth, or evident lobe in the opposed edges of one or both mandibles near the end; as in the shrike, vireo, and some wrens, thrushes, and warblers. 4. The *conirostral* (Lat. *conus*, a cone), or conical, sufficiently defined by its name, and illustrated by the great finch family and some allied ones. — B, among water birds. 5. The *longirostral* (Lat. *longus*, long), or long, an aquatic style of the tenuirostral, best exhibited in the great snipe family. 6. The *pressirostral* (Lat. *pressus*, pressed), or the compact, illustrated by the plovers, etc., and quite likely analogous to the conirostral. 7. The *cultrirostral* (Lat. *culter*, a knife), cutting, perhaps analogous to the dentirostral, exemplified in the heron group. None of these terms are now used to indicate natural groups, nor have we such absurdities as the "orders" *Fissirostres*, *Tenuirostres*, etc. A swallow, for instance, and a swift are equally fissirostral, though only distantly related to each other; a swift is very closely related to a humming-bird, though the latter is extremely tenuirostral; and birds of contiguous genera may be dentirostral or not. The words are nevertheless convenient incidental terms in general descriptions. Various other similar terms, expressing special modifications, as *lamellirostral* (Lat. *lamella*, a plate), *acutirostral* (Lat. *acutus*, sharp), etc., are also employed as common names, simply descriptive of

Other Forms. — A bill is called *long*, when notably longer than the head proper; *short*, when notably shorter; *medium*, in neither of these conditions. It is *compressed*, when higher than wide, at the base at least, and generally for some portion of its length; *depressed*, when wider than high; *terete* (Lat. *teres*, cylindric), under neither of these conditions. It is *recurved*, when curved upward; *decurved*, when curved downward; *bent*, when the variation in either direction is at an angle; *straight*, when not out of line with the axis of the head. A bill is

obtuse (said chiefly of the paragnathous sort) when it rapidly comes to an end that therefore is not fine; or when the end is knobby; it is *acute* when it runs to a sharp point; *acuminate*, when equally sharp and slenderer; *attenuate*, when still slenderer; *subulate* (awl-shaped), when slenderer still; *acicular* (needle-shaped), when slenderest possible, as in some hummingbirds. A bill is *arched*, *vaulted*, *turgid*, *tumid*, *inflated*, etc., when its outlines, both crosswise and lengthwise, are notably more or less convex; and *contracted*, when some, or the principal, outlines are concave (said chiefly of depressions about the base of the upper mandible, or of concavity along the sides of both mandibles). A bill is *hamulate* (Lat. *hamus*, a hook), or *unguiculate* (Lat. *unguis*, a claw), when strongly epignathous, as in rapacious birds, where the upper mandible is like the talon of a carnivorous beast; it is *dentate*, when toothed, as in a falcon; if there are a number of similar "teeth," it is *serrate* (Lat. *serra*, a saw), like a saw; it is *cultrate* (knife-like), when extremely compressed and sharp-edged, as in the auk, skimmer; if much curved as well as cultrate, it is *falcate* (Lat. *falx*, a reaping-hook; scythe-shaped); and each mandible may be oppositely falcate, as in the cross-bill, constituting metagnathism. A bill much flattened and widened at the end (rare) is *spatulate* (Lat. *spatula*, a spoon); examples: spoonbill, shoveller duck. One is called *lamellate*, when it has a series of plates or processes just inside the edges of the mandibles; as in all the duck order, and in a few petrels; the design is to furnish a sifter or strainer of water, just what is effected in the whale, by the "bone" in its mouth. Finally, the far end of the bill, of whatever shape, is called the *tip* or *apex* (fig. 26, *n*); the near end, joined to the rest of the skull, the *base*; the rest is the *continuity*. Some other features of the bill as a whole are best treated under separate head of

The Covering of the Bill. — (*a.*) In the great majority of birds, including nearly all perchers, many walkers, and some waders and swimmers, the sheathing of the mandibles is wholly *hard*, *horny*, or *corneous* (Lat. *cornu*, a horn); it is integument modified much as in the case of the nails or claws of beasts. In nearly all waders and most swimmers, the sheath becomes, wholly or partly, softer, and is of a dense, leathery texture. But some swimmers, as among the auks, furnish bills as hard-covered as any, while some perchers have it partly quite soft, so that no unexceptional rule can be laid down; and, moreover, the gradations from one extreme to the other are insensible. Probably the softest bill is found among the snipes, where it is skinny throughout, and in typical snipes and woodcocks vascular and nervous at the tip, becoming a true organ of touch, used to feel for worms out of sight in the mud. In all the duck order the bill is likewise soft; but there it is always terminated by a hard, horny, *unguis* or "nail," more or less distinct; and such a horny claw also occurs in other water birds with softish bills, as the pelican. An interesting modification occurs in all, or nearly all, of the pigeon order; these birds have the bill hard or hardish at tip and through most of continuity, but towards and at the base of the upper mandible the sheath changes to a soft, tumid, skinny texture, overarching the nostrils; it is much the same with most plovers. But the most important feature in this connection is afforded by the parrots and all the birds of prey; one so remarkable that it has received a distinct name: CERE. The cere (Lat. *cera*, wax; because it looks waxy) is a dense membrane saddled on the upper mandible at base, so different from the rest of the bill, that it might be questioned whether it does not more properly belong to the head than to the bill, were it not for the fact that the nostrils open in it. Moreover, the cere is often densely feathered, as in the Carolina paroquet, in the bill proper of which no nostrils are seen, these being hidden in the feathered cere, which, therefore, might easily be mistaken at first sight for the bird's forehead. A sort of false cere occurs in some water birds, as the jaegers, or skuagulls (genus *Stercorarius*). The tumid nasal skin of pigeons is sometimes called a cere; but the term had better be restricted to the birds first above named. The under mandible probably never presents softening except as a part of general skinniness of the bill; it may have a nail at the end. (*b.*) The covering is either *entire* or *pieced*. In most birds it is entire; that is, the

sheath of either mandible may be pulled off whole, like the finger of a glove. It is, however, in many birds divided into parts, by various lines of slight connection, and then comes off in pieces; as is the case with some water birds, particularly petrels, where the divisions are regular, and the pieces have received distinctive names. Many auks (*Alcidæ*) have the covering of the bill in particular pieces, and it is an extraordinary fact that such parts are of a secondary sexual character (see p. 90), being assumed at the breeding season and afterwards *moulted* like feathers. Such condition of the sheath of the beak, or of special developments of the sheath, is called *caducous* or *deciduous*. The entire covering of both jaws together is called *rhamphotheca* (Gr. ῥάμφος, *hramphos*, beak; θήκη, *theke*, a sheath), of the upper alone, *rhinotheca* (Gr. ῥίς, *hris*, the nose); of the under, *gnathotheca* (Gr. γνάθος, *gnathos*, jaw); but these terms are not much used. (*c.*) The covering is otherwise variously marked; sometimes so strongly that similar features are impressed upon the bones themselves beneath. The most frequent marks are various *ridges* (Lat. pl. *carinæ*, keels) of all lengths and degrees of expression, straight or curved, vertical, oblique, horizontal, lengthwise, or transverse; a bill so marked is said to be *striate* (Lat. *stria*, a streak) or *carinate;* when numerous and irregular, they are called *rugæ* (Lat. *ruga*, a wrinkle) and the bill is said to be *corrugated* or *rugose*. When the elevations are in points or spots instead of lines, they are called *puncta* (Lat. *punctum*, a point); a bill so furnished is *punctate*, but the last word is oftener employed to designate the presence of little *pits* or depressions, as in the dried bill of a snipe towards the end. Larger softish, irregular knobs or elevations pass under the general name of *warts* or *papillæ*, and a bill so marked is *papillose;* when the processes are very large and soft, the bill is said to be *carunculate* (Lat. *caro*, flesh, diminutive *carunculus*, little bit of flesh). Various linear *depressions*, often but not always associated with carinæ, are grooves or *sulci* (Lat. *sulcus*, a furrow) and the bill is then called *sulcate*. Sulci, like carinæ, are of all shapes, sizes, and positions; when very large and definite, they are sometimes called *canaliculi*, or channels. The various knobs, "horns," and large special features of the bill cannot be here particularized. Any of the foregoing features may occur on both mandibles, and they are exclusive of that special mark of the upper the nasal *fossa* in which the nostrils open, and which is considered below. We have still to notice the special parts of either mandible; and will begin with the simplest, the

Under Mandible. — In the majority of birds it is a little shorter and a little narrower and not nearly so deep as the upper; but sometimes quite as large, or even larger. The upper edge, double (*i. e.*, there is an edge on both sides), is called the mandibular *tomium*, or in the plural, *tomia* (Gr. τέμνειν, *temnein*, to cut; fig. 26, *j*), as far as it is hard; this is received against, and usually a little within, the corresponding edge of the upper mandible. The prongs already mentioned are the mandibular *rami* (pl. of Lat. *ramus*, a branch; fig. 26, *i*); these meet at some point in front, either at a short angle (like >) or with a rounded joining (like ⊐). At their point of union there is a prominence, more or less marked (fig. 26, *k*); this is the GONYS (corrupted from the Gr. γόνυ, *gonu*, a knee; hence, any similar protuberance). That is to say, this point is gonys proper; but the term is extended to apply to the whole line of union of the rami, from gonys proper to the tip of the under mandible; and in descriptions it means, then, the *under outline of the bill* for a corresponding distance (fig. 26, *l*). This important term must be understood; it is constantly used in describing birds. The gonys is to the under mandible what the keel is to a boat; it is the opposite of the ridge or *culmen* of the upper mandible. It varies greatly in length. Ordinarily it forms, say, one-half to three-fourths of the under outline. Sometimes, as in conirostral birds, a sparrow for example, it represents nearly all this outline; while in a few birds it makes the whole, and in some, as the puffin, is actually longer than the lower mandible proper, because it extends backwards in a point. Other birds may have almost no gonys at all; as a pelican, where the rami

only meet at the extreme tip, or in the whole duck family, where there is hardly more. As the student must see, the length of the gonys is simply a matter of how extensive is the fusion of the rami, and that, similarly, their mode of fusion, as in a sharp ridge, a flat surface, a straight line, a curve, etc., results in corresponding modifications of its special shape. The *interramal space* is complementary to length of gonys: sometimes it runs to the tip of the bill, as in a pelican, sometimes there is next to none, as in a puffin; while its width depends upon the degree of divergence, and the straightness or curvature, of the rami. The surface between the tomium and lower edge of rami and gonys together is the *side of the under mandible* (fig. 26, *m*). The most important feature of the

Upper Mandible is the *culmen* (Lat. for top of anything; fig. 26, *b*). The culmen is to the upper mandible what the ridge is to the roof of a house; it is the upper profile of the bill — the *highest middle lengthwise line of the bill;* it begins where the feathers end on the forehead, and extends to the tip of the upper mandible. According to the shape of the bill it may be straight or convex, or concave, or even somewhat ∝-shaped; or double-convex, as in the tufted puffin: but in the great majority of cases it is convex, with increasing convexity towards the tip. Sometimes it rises up into a thin elevated crest, as well shown in the genus *Crotophaga*, and in the puffins (*Fratercula*), when the upper mandible is said to be *keeled*, and the culmen itself to be *cultrate;* sometimes it is really a furrow instead of a ridge, as toward the end of a snipe's bill; but generally it is simply the uppermost line of union of the gently convex and sloping *sides of the upper mandible* (fig. 26, *a*). In a great many birds, especially those with depressed bill, as all the ducks, there is really no culmen; but then the *median lengthwise* line of the surface of the upper mandible takes the place and name of culmen. The culmen generally stops short about opposite the proper base of the bill; then the feathers sweep across its end, and downwards across the base of the sides of the upper mandible, usually also obliquely backwards. Variations in both directions from this standard are frequent; the feathers may run out in a point on the culmen, shortening the latter, or the culmen may run a way up the forehead, parting the feathers; either in a point, as in the rails and gallinaceous birds, or as a broad plate of horn, as in the coots and gallinules. The lower edge (double) of the upper mandible is the *maxillary tomium*, as far backward as it is hard and horny. The most conspicuous feature of the upper mandible in most birds is the

Nasal Fossa (Lat. *fossa*, a ditch), or *nasal groove* (fig. 26, *c*), in which the nostrils open. The upper prong of the intermaxillary bone is usually separated some ways from the two lateral prongs; the skinny or horny sheath that stretches betwixt them is usually sunken below the general level of the bill, especially in those birds where the prongs are long or widely separated; this "ditch" is what we are about. It is called *fossa* when short and wide, with varying depth; *sulcus* or groove when long and narrow; the former is well illustrated in the gallinaceous birds; the latter in nearly all wading birds and many swimmers. When the intermaxillary prongs are soldered throughout, or are very short and close together, there is no (or no evident) nasal depression, the nostrils then opening flush with the level of the bill. The

Nostrils (fig. 26, *d*), two in number, vary in *position* as follows: — they are *lateral*, when on the sides of the upper mandible (almost always); *culminal*, when together on the ridge (rare); *superior* or *inferior* when evidently above or below midway betwixt culmen and tomia; they are *basal*, when at the base of the upper mandible; *sub-basal* when near it (usual); *median* when at or near the middle of the upper mandible (frequent, as in cranes, geese, etc.); *terminal* when beyond this (very rare; probably there are now *no* birds with nostrils at the end of the bill, except the *Apteryx*). The nostrils are *pervious*, when open, as in nearly all

birds; *impervious*, when not visibly open, as among cormorants and other birds of the same order; they are *perforate* when there is no *septum* (partition) between them, so that you can look through them from one side of the bill to the other, as in the turkey-buzzard, crane, etc.; *imperforate* when partitioned off from each other, as in most birds; but different ornithologists use these terms interchangeably. The principal *shapes* of the nostrils may be thus exhibited: — a line, *linear* nostrils; a line variously enlarged at either end, *clavate, club-shaped, oblong, ovate* nostrils; a line, enlarged in the middle, *oval* or *elliptic* nostrils; this passing insensibly into the circle, *round* or *circular* nostrils; and the various kinds of more or less linear nostrils may be either longitudinal, as in most birds, or oblique, as in a few; almost never directly transverse (up and down). Rounded nostrils may have a raised border or *rim;* when this is prolonged they are called *tubular*, as in some of the goatsucker family, and in all the petrels. Usually, the nostrils are defined entirely by the substance surrounding them; thus, of cere, in a hawk; of softish skin, in a pigeon, plover or snipe; or of horn, in most birds; but often their contour is partly formed by a special development, somewhat distinct either in form or texture, and this is called the *nasal scale*. Generally, it forms a sort of overhanging arch or portico, as well shown in all the gallinaceous birds, among the wrens, etc. A very curious case of this is seen in the European wryneck (*Iynx torquilla*), where the scale forms the floor instead of the roof of the nostrils. The nostrils also vary in being *feathered* or *naked*; the nasal fossa being a place where the frontal feathers are apt to run out in points (called *antiæ*), embracing the root of the culmen. This extension may completely fill and hide the fossa, as in many grouse and ptarmigan; but it oftener runs for a varying distance toward, or *above* and beyond, the nostrils; sometimes similarly below them, as in a chimney-swift; and the nostrils may be densely feathered when there is no evident fossa, as in an auk. When thus truly feathered in varying degree, they are still open to view; another condition is, their being covered over and hidden by modified feathers not growing on the bill itself, but on the forehead. These are usually bristle-like (*setaceous*), and form two tufts, close-pressed and directed forwards, as is perfectly shown in a crow; or, the feathers may be less modified in texture, and form either two *tufts*, one over each nostril, or a single *ruff*, embracing the whole base of the upper mandible; as in nuthatches, titmice, red-poll linnets, snow buntings and many other northern *Fringillidæ*. Bristles or feathers thus growing forwards are called *retrorse* (Lat. *retrorsum*, backward; here used in the sense of *in an opposite direction from* the lay of the general plumage; but they should properly be called *antrorse, i. e.*, forward). The nostrils, whether culminal or lateral, are, like the eyes and ears, *always two* in number, though they may be united in one tube, as in the petrels.

The Gape. — It only remains to consider what results from the relations of the two mandibles to each other. When the bill is opened, there is a cleft or fissure between them; this is the *gape* or *rictus* (Lat. *rictus*, mouth in the act of grinning). But while thus really meaning the open *space* between the mandibles, it is generally used to signify the *line of their closure*. *Commissure* (Lat. *committere*, to put or join together) means the point where the gape ends behind, that is, the *angle of the mouth, angulus oris*, where the apposed edges of the mandibles join each other; but, as in the last case, it is loosely applied to the whole line of closure, from true commissure to tip of the bill. So we say, "commissure straight," or "commissure curved;" also, "commissural edge" of either mandible (equivalent to "tomial edge") in distinction from culmen or gonys. But it would be well to have more precision in this matter. Let, then, *tomia* (fig. 26, *j*) be the true cutting edges of either mandible from tip to opposite base of bill proper; *rictus* (fig. 26, *g*) be their edges thence to the POINT *commissure* (fig. 26, *h*) where they join when the bill is open; the LINE commissure (fig. 26, *f*) to include both when the bill is closed. The gape is *straight*, when rictus and tomia are both straight and lie in the same line; *curved, sinuate,* when they lie in the same curved or waved

line; *angulated*, when they are straight, or nearly so, but do not lie in the same line, and therefore meet at an angle. (An important distinction. See under family *Fringillidæ* in the Synopsis.)

II. THE WINGS.

Definition. — Pair of anterior or *pectoral* limbs organized for flight by means of dermal outgrowths. Used for this purpose by birds in general; but by ostriches and their allies only as outriggers to aid running: by penguins as fins for swimming under water; used also in the latter capacity by some birds that fly well, as divers, cormorants, dippers. Wanting in no recent birds, but imperfect in a few, as all *Ratitæ*; greatly reduced in the Emeu, Cassowary, and Apteryx; also in the Moas (*Dinornis*); in the Cretaceous *Hesperornis* only the rudimentary humerus is known. To understand their structure we must notice particularly

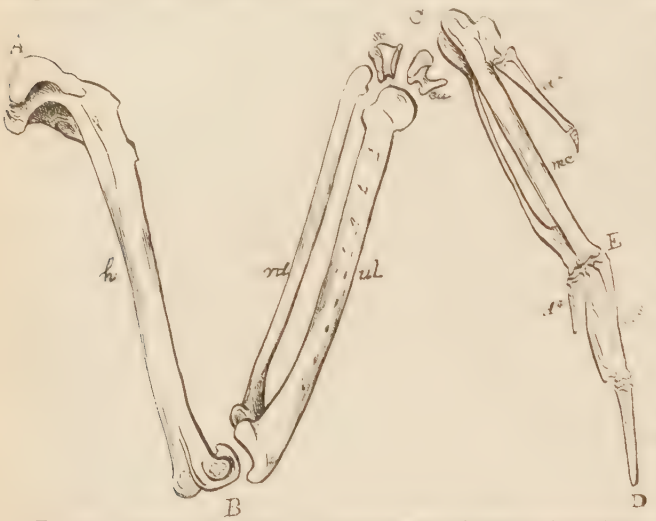


FIG. 27. — Bones of right wing of a duck, *Clangula islandica*, from above, ⅓ nat. size. (Dr. R. W. Shufeldt, U.S.A.) *A*, shoulder, *omos*: *B*, elbow, *ancon*; *C*, wrist, *carpus*: *D*, end of principal finger; *E*, end of hand proper, *metacarpus*. *A B*, upper arm, *brachium*: *B C*, fore-arm, *antibrachium*: *C D*, whole hand or pinion, *manus*; composed of *C E*, hand proper or *metacarpus*, excepting d^2; *E D*, or d^2 d^3, d^4, fingers, digits, *digiti*. *h*, *humerus*: *rd*, *radius*; *ul*, *ulna*; *sc*, outer carpal, *scapholunare* or *radiale*: *cu*, inner carpal, *cuneiforme* or *ulnare*; these two composing wrist or *carpus*. *mc*, the compound hand-bone, or *metacarpus*, composed of three metacarpal bones, bearing as many digits — the outer digit seated upon a protuberance at the head of the metacarpal, the other two situated at the end of the bone. d^2, the outer or radial digit, commonly called the thumb or *pollex*, composed of two *phalanges*: d^3, the middle digit, of two phalanges; d^4, the inner or ulnar digit, of one phalanx. d^2 is the seat of the feathers of the *bastard wing* or *alula*. *D* to *C* (whole pinion), seat of the flight-feathers called *primaries*: *C* to *B* (fore-arm), seat of the *secondaries*: at *B* and above it in direction of *A*, seat of *tertiaries* proper; below *A*, in direction of *B*, seat of *scapularies* (upon pteryla humeralis), often called tertiaries. The wing shown half-spread: complete extension would bring *A B C D* into a right line; in complete folding *C* goes to *A*, and *D* to *B*: all these motions *nearly* in the plane of the paper. The elbow-joint and wrist are such perfect hinges, that, in opening or closing the wing, *C* cannot sink below the paper, nor *D* fly up above the paper, as would otherwise be the effect of the pressure of the air upon the flight-feathers. Observe also: *rd* and *ul* are two rods connecting *B* and *C*; the construction of their jointing at *B* and *C*, and with each other, is such, that they can *slide lengthwise* a little upon each other. Now when the point *C*, revolving about *B*, approaches *A* in the arc of a circle, *rd* pushes on *sc*, while *ul* pulls back *cu*: the motion is transmitted to *D*, and makes this point approach *B*. Conversely, in opening the wing, *rd* pulls back *sc*, and *ul* pushes on *cu*, making *D* recede from *B*. In other words, the angle *A B C* cannot be increased or diminished without similarly increasing or diminishing the angle *B C D*; so that no part of the wing can be opened or shut without automatically opening or shutting the rest, — an interesting mechanism by which muscular power is correlated and economized. This latter mechanism is further illustrated in fig. 28, where *rc* and *uc* show respectively the size, shape and position of the radial condyle and ulnar condyle of the humerus. It is evident that in the flexed state of the elbow, as shown in the middle figure, the radius, *rd*, is so pushed upon that its end projects beyond *ul*, the ulna; while in the opposite condition of extension, shown in the lower figure, *rd* is pulled back to a corresponding extent.

The Bony Framework (figs. 27, 28, 29). — The skeleton of a bird's wing is built upon a plan common to the fore or pectoral limb of all the higher vertebrates, so that its bones and joints may readily be compared and identified with those of any lizard or mammal, including man. But the member is highly specialized; being fitted for accomplishing flight, not only by the development of feathers, but also by modifications in the bones themselves. The axes of the bones have a special direction with reference to each other and to the axes of the body; the movements of the joints are peculiar in some respects; and the whole extremity of the wing, from the wrist outward, is peculiarly con-

structed, by loss of some of the digits that five-fingered animals possess, and by the compression of those that are left. The wing proper begins at the shoulder-joint, where it hinges freely upon the shoulder, in a shallow socket formed conjointly by the shoulder-blade or *scapula*, and by the *coracoid* bone; these two, with the clavicles, collar-bones or merry-thought, *furculum*, forming the *shoulder-girdle*, or *pectoral arch* (figs. 56, 59).

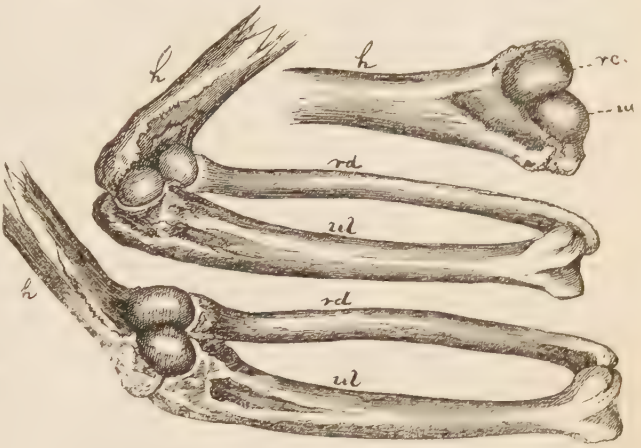
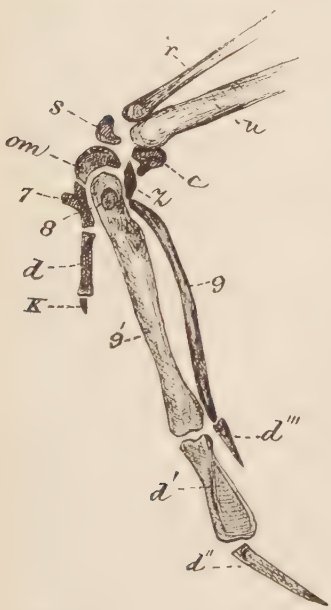


FIG. 28. — Mechanism of elbow-joint. (See explanation of fig. 27.)

The wing ordinarily consists, in adult life, of *ten* or *eleven* actually separate bones; in the embryo (see fig. 29) there are indications of several more at the wrist-joint, which speedily lose their individual identity by fusing together and with bones of the hand. Aside from these, there is often an accessory ossicle at the shoulder-joint (fig. 56, *ohs*), sometimes one at the wrist-joint, occasionally an extra bone at the end of the principal finger. The normal or usual number is shown in fig. 27, taken from a duck (*Clangula islandica*), in which there are eleven.



The upper arm-bone, *h*, reaching from the shoulder *A* to the elbow *B*, is the *humerus*. In the closed wing, the humerus lies nearly in the position of the same bone in man when the elbow is against the side of the body; in extension of the wing, the elbow is borne away from the body, as when we raise the arm, but carry it neither forward nor backward. A peculiarity of the bird's humerus is, that it is rotated on its axis through about the quadrant of a circle, so that what is the front of the human bone is the outer aspect in the bird. The humerus is a cylindric bone, straightish or somewhat italic *f*-shaped, with a globular head to fit the socket of the shoulder, a strong pectoral ridge for insertion of the breast muscles, and at the bottom two *condyles* (fig. 28, *rc*, *uc*,) or joint-surfaces for articulation with a pair of succeeding bones. The fore-arm, *cubit* or *antibrachium*, extending from elbow to wrist, *B* to *C*, in fig. 27, has two parallel bones of about equal lengths. These are the *ulna*, *ul*, and the *radius*, *rd*; the former, inner and posterior, the larger of the two, bearing the quills of the secondary series; the latter, slenderer, outer and anterior. The enlarged proximal extremity of the ulna is called the *olecranon*, or "head of the

FIG. 29, from a *young* grouse (*Centrocercus urophasianus*, six months old), is designed to show the composition of the carpus and metacarpus before the elements of these bones fuse together: *r*, radius; *u*, ulna; *s*, scapholunar or radiale; *c*, cuneiform or ulnare; *om*, a carpal bone believed to be os magnum, later fusing with the metacarpus; *z*, a carpal bone, supposed to be unciform, later fusing with metacarpus; 8, an unidentified fifth carpal bone, which may be called *pentosteon*, later fusing with the metacarpus; 7, radial or outer metacarpal bone, bearing the pollex or outer digit, consisting of two phalanges, *d* and *k*; 9', principal (median) metacarpal bone, bearing the middle finger, consisting of the two phalanges, *d'*, *d''*; 9, inner or ulnar metacarpal, bearing a digit of one phalanx, *d'''*. The pieces marked *om*, *z*, 7, 8, 9. all fuse with 9'. (From nature by Dr. R. W. Shufeldt, U. S. A.)

elbow." The third segment of the wing is the wrist or *carpus*. In adult life, this normally consists of two little knobby carpal bones, extremely irregular in shape, called the *scapholunar*, *sc*, and *cuneiform*, *cu*. One being at the end of the radius, the other at that of the ulna, they are also called *radiale* and *ulnare*. In the embryo, there is at least another carpal bone, that early fuses with the next segment. This fourth segment is the *hand* proper, or *metacarpus*, *mc*, *C* to *E* (exclusive of *d* 2). The single metacarpal or hand-bone is very composite; that is, compounded of several; for, besides including certain carpal elements, as already said, it consists of three bones fused (in all recent birds) in one, corresponding to the three digits or fingers that birds possess. In fact it is three metacarpals in one. The metacarpal corresponding to the principal finger is much the largest of the three; that of the first finger is very short, being only the expanded part seen in the figure just above the bone marked *d* 2; that of the third finger is nearly as long as the main metacarpal, but much slenderer, and usually fused only at its two ends, leaving between itself and the main metacarpal a considerable space, as seen opposite the letters *mc* in the figure. The wing is finished off with three fingers or *digits*, marked *d* 2, *d* 3, *d* 4. The middle one of these, *E* to *D* in the figure, is much the largest, and forms the main continuation of the hand. This digit, *d* 3, ordinarily consists of two bones, called *phalanges*, placed end to end, as in the example before us; but occasionally there is found a third phalanx. The outer or radial digit, *d* 2, ordinarily consists of two bones, of which the terminal one is small, and may be wanting. The inner or ulnar digit, *d* 4, consists of a single small phalanx, closely bound to the side of the middle finger. Corresponding to the compactness and consolidation of these terminal segments, the digits enjoy little individual motion. The outer or radial digit is the most independent one. In the *Archæopteryx* the three metacarpals were free bones, and the whole hand more like that of a lizard. No bird now has free metacarpals in adult life; none has more than three digits. These three are supposed by some to correspond to the thumb and fore and middle fingers of our hands; by others, to the fore, middle, and ring fingers, and being consequently the second, third, and fourth digits, as marked in the figure. The digit marked *d* 2 is commonly called a bird's *thumb* or *pollex*. The *Apteryx* and the cassowary have but one complete digit. The resemblance to a lizard's or quadruped's digits is increased by the *claws* which many birds possess. These may be borne on the enlarged terminal phalanx of *d* 2 (*k*, in fig. 29), as is very well shown in the turkey-buzzard and other American *Cathartidæ;* both on this and on the terminal phalanx of *d* 3 (*d''* in fig. 29), as in the ostrich; on the latter alone, as in the *Apteryx*, cassowary, American ostrich, and swan. The inner finger, *d* 4 (*d'''* in fig. 29) is not known to ever bear a claw, excepting in *Archæopteryx*. The whole segment, *C* to *D*, is commonly called "the hand," "pinion," or *manus*, though, as we have seen, it consists of hand proper (metacarpus), and fingers (digits) with their respective phalanges. (Fig. 112 *ter.*)

Some other bones are observed in birds' wings. As already said, there is a little ossicle in the shoulder-joint of many birds; it is called the *scapula accessoria* (fig. 56, *ohs*). At the convexity of the elbow there may be one or more ossicles, not pertaining properly to the wing-skeleton, but developed in the tendons of muscles passing over the joint: they are *sesamoids*, like the human patella, or knee-cap. In various birds there is found at the convexity of the wrist, on the head of the metacarpal, an ossicle called the *os prominens;* apparently a sesamoid. Some other ossicles observed in the wrists of young birds are all supposed to be carpal elements, the exact homologies of which may be still questioned.

The Mechanism of these Bones is admirable. The shoulder-joint is free, much like our own, permitting the humerus to swing all about; though the principal motions are to and from the side of the body (*adduction* and *abduction*), and up and down in a vertical plane. The elbow-joint is a very strict hinge, permitting motion in one plane, nearly that of the wing itself. The finger-bones have little individual motion. The construction of the wrist-joint is

quite peculiar. In the first place the two bones of the forearm are so fixed in relation to each other, that the radius cannot roll over the ulna, like ours. If you stretch your arm upon the table, you can, without moving the elbow, turn the hand over so that either the palm or the knuckles are downward. This is a rotary motion of the bones of the forearm, called *pronation* and *supination;* the prone when the palm touches the table, supine when the knuckles are downward. This rotation is absent from the bird's arm; if it could occur, the action of the air upon the pinion-feathers would throw them all "at sea" during the strokes of the wing, rendering flight difficult or impossible. The hingeing of the hand upon the wrist is such, also, that the hand does not move up and down, as ours can, in a plane perpendicular to the surface of the wing, but in the same plane as that surface. The motion is that which would take place in our hand if we could bring the little finger and its border of the hand so far around as to touch the corresponding border of the forearm. It is a motion of adduction, not of flexion, and its opposite, abduction, not extension, by which a wing is folded and spread. Such *abduction* is the way in which the hand is "extended" upon the wrist-joint, increasing and completing the unfolding of the wing that begins by the true extension of the forearm upon the elbow and abduction of the upper arm from the body. In a word, a wing is spread by the motion of abduction at the shoulder and wrist, of extension at the elbow; it is closed by adduction at the shoulder and wrist, and flexion at the elbow. The numerous muscles which unfold or straighten out the wing are called *extensors;* those that bend or close it are *flexors*. Extensors lie upon the back of the upper arm, and the front of the forearm and hand, their "leaders" or tendons passing over the *convexities* of the elbow and of the wrist. The flexors occupy the opposite sides of the limb, with tendons in the concavities of the joints. The most powerful muscles of the wings are the great *pectoral* or breast muscles, acting upon the upper end of the humerus; there are several of them, exerted in throwing out the arm from the body, and in giving both the up and down wing-strokes. Tendons are generally strong inelastic cords; but there is an interesting arrangement of an elastic cord in a bird's wing. In fig. 27, *A B C* is a deep angle formed by the naked bones, but none such is visible from the exterior, because the space is filled by a fold of skin passing from *C* to near *A*. But *C* approaches and recedes from *A* as the wing is folded or unfolded, and a cord long enough to reach *A–C* would be slack in the folded wing, did not its elasticity enable it to contract and stretch, keeping the anterior border of the wing straight and smooth. (For another automatic mechanism, see explanation of fig. 28.)

The point *C* is a highly important landmark in practical ornithology; it represents, in any folded wing, a very prominent point, the distance from which to the tip of the longest flight-feather is a special measurement known as that of "the wing." It is the convexity of the carpus, commonly called the "carpal angle," or "bend of the wing." Having thus glanced at the bony structure and mechanism of the wing, we are ready to examine the

Feathers of the Wing (fig. 30). — How important these are will be evident from the consideration that they are the bird's chief *organs of locomotion;* for without them the wing would be useless for flight. We also remember that such means of locomotion is the great specialty of birds. Wing-feathers are those which grow upon the *pteryla alaris*. They are of two main sorts: the *flight-feathers* proper, or long stiff quills, collectively called *remiges* (Lat. *remex*, pl. *remiges*, rowers); and the smaller, weaker feathers overlying them, and hence called *coverts*, or *tectrices* (Lat. *tectrix*, pl. *tectrices*, coverers). To these may be added as a third distinct group the *bastard quills*, which constitute the

Alula, or Ala Spuria (Lat. *alula*, little wing, diminutive of *ala*, wing; *spuria*, spurious, bastard). The "little wing" is simply the small parcel of feathers which grow upon the "thumb" (see fig. 27, *d* 2; 29, *d* and *k;* 30, *al*). Highly significant as these may be in a morphological point of view, as representing what this part of the wing may have been in early times,

they are so much reduced in modern birds as to be of little account in practical ornithology. In fact, the unpractised student may fail to recognize them at first. They form a small packet on the fore outer border of the pinion near the carpal angle, and lie smoothly upon the upper surface of the wing, strengthening and finishing off what would be otherwise a weak spot in the contour of the wing-border. It is quite easy, on recognizing them, to lift them collectively a little away from the other feathers, owing to the slight mobility the thumb possesses. In fact, they are sometimes quite obtrusive, when faulty taxidermy has discomposed them. They are not often conspicuously modified either in size or color. In a few birds (*e.g.*, *Cathartes*), a *claw* will be found at the end of the joint which bears them. The student must be careful to discriminate between the use of the word *spurious* in the present connection and its application to a rudimentary condition of the first *remex* (see p. 113). The

Wing-Coverts overlie the bases of the large quills on both the upper and under surfaces of the wing. They are therefore conveniently divided into an *upper* set (*tectrices superiores*) and an under set (*tect. inferiores*). The former are so much more conspicuous than the latter that they are always understood when "upper" is not specified. The latter are sometimes collectively called "the lining of the wings." Coverts include all the *small* feathers of the wings excepting the bastard quills: they extend a varying distance along the bases of the flight-feathers. The ordinary disposition and division of the upper coverts is as follows: One set, rather long and stiffish, grow upon the pinion, and are close-pressed upon the bases of the outer nine or ten remiges, covering these large feathers about as far as their structure is plumulaceous. These are the *upper* PRIMARY *coverts*, or coverts of the primaries (fig. 30, *pc*): they are ordinarily the least conspicuous of any. All the rest of the upper coverts are SECONDARY; they spring mostly from the forearm. These are considered in three groups or *rows*. The *greater upper secondary coverts*, called simply the "greater coverts" (*tectrices majores*, fig. 30, *gsc*.) are the first, outermost, longest row, reaching nearest the tips of the flight-feathers; they overlie the bases of nearly all the remiges, excepting the first nine or ten. The *median upper secondary coverts*, shortly known as the "middle coverts" (*tectrices mediæ*), are a next row, shorter and therefore less exposed, but still quite evidently forming a special series (fig. 30, *msc*). It is a common feature of these median coverts that they shingle over each other contrary-wise to the way the greater coverts are imbricated, the outer vane of one being under the inner vane of the next outer one. All the rest of the upper secondary coverts, forming several indistinguishable rows, pass under the general name of *lesser coverts* (*tectrices minores*; fig. 30, *lc*). The greater coverts furnish an excellent zoölogical character; for in no *Passeres* are they more than half as long as the remiges they cover, while the reverse is the case in most birds of lower orders. Woodpeckers, however, though non-passerine, have quite short coverts. The *under coverts* have the same general arrangement as the upper; but

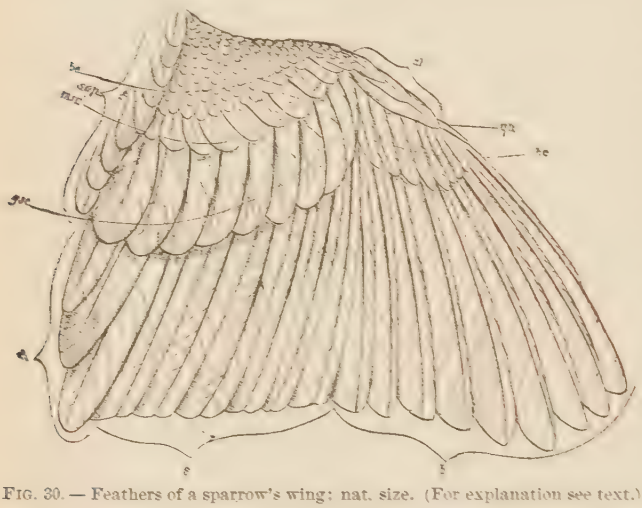


FIG. 30. — Feathers of a sparrow's wing: nat. size. (For explanation see text.)

they are more alike and less distinctly disposed in rows or series; so that for practical purposes they pass under the general name of under wing-coverts, or *lining of the wing*. Since, when the wing is particularly marked on the under side, it is the coverts and not the remiges that are highly or variously colored, the common expression "wing below," or "under surface of the wing," refers to the coverts more particularly. We should distinguish, however, from the under coverts in general, the *axillars*, or axillary feathers (Lat. *axilla*, the arm-pit). These are the innermost feathers lining the wings, lying close to the body; almost always longer, stiffer, narrower, or otherwise peculiarly modified. In ducks, for example, and many of the waders, as snipe and plover, they are remarkably well developed. The color of the axillaries is the principal distinction between some species of plovers. The

Remiges, or Flight-Feathers (fig. 30, *b*, *s*, and *t*), give the wing its general character, mainly determining both its size and its shape; they represent most of its surface and of its inner and outer borders, and all of its posterior outline, forming a great expansion of which the bony and fleshy framework is insignificant in comparison. The shape of the wing is indeed primarily affected by the relative lengths of its bony segments, the upper arm being, in a humming-bird, for example, very short in comparison with the terminal portion of the limb, and in an albatross again, both upper and forearm being greatly lengthened; still in any case it is the flight-feathers that mainly determine the contour of the wing, by their absolute degree of development, their lengths proportionately to one another, and their individual shapes. They collectively form a thin, elastic, flattened surface for striking the air, quite firm along the front border where the bone and muscle lie, thence growing more mobile and resilient toward the posterior border and along the outer edge. Such surface may be quite flat, as in such birds as cut the air with long, pointed wings, like oar-blades; but it is generally a little concave underneath and correspondingly convex above; such arching or vaulting of the wing-surface being usually associated with a short, broad, rounded wing, as in the gallinaceous tribe, and being least in birds which have the thinnest and sharpest wings. Corresponding differences in the mode of flight result. The short, rounded wing confers a powerful though labored flight for short distances, usually accompanied by a whirring noise resulting from the rapidity of the wing-beats; birds that fly thus are almost always thickset and heavy. The long, pointed wing gives a noiseless, airy, skimming flight, indefinitely prolonged, and accomplished with more deliberate wing-beats; birds of this style of wing are generally trim and elegant. These, of course, are merely generalizations of the extremes of modes of flight, mixed and gradated in every degree in actual bird-life. Thus the humming-bird, which has sharp, thin wings, whirs them fastest of all birds, — so rapidly that the eye cannot follow the strokes, merely perceiving a haze about the bird while the ear hears the buzzing. The combination of acuteness and concavo-convexity is a remarkably strong one, conferring a rapid, vigorous, whistling flight, as that of a duck or pigeon, or the splendid hurtling of a falcon. An ample wing, as one both long and broad without being pointed is called, is well displayed by such birds as herons, ibises, and cranes; the flight may be strong and sustained, but is rather slow and heavy. The longest-winged birds are found among the swimmers, particularly the pelagic family of the petrels, and some of the whole-webbed order, as pelicans, particularly the frigate-pelican. The last named, *Tachypetes aquilus*, has perhaps the longest wings for its bulk of body of any bird whatever, as well as the shortest feet. The American vultures are likewise of great alar expanse in proportion to their weight. The shortest wings, among birds possessing perfect remiges, occur among the lower swimmers, as auks and divers, and among some of the Gallinæ. The great auk is, or was, perhaps the only flightless bird with well-formed flight-feathers, only too small to subserve their usual purpose; though certain South American ducks are said to be in similar predicament. In the penguins, the whole wing-structure is degraded, and the remiges abort in scale-like feathers, the wings being reduced to fins both

in form and function. The whole of the existing *Ratitæ* have rudimentary or very imperfect wings, as was the case with the Cretaceous *Hesperornis;* but the contemporary of the latter, *Ichthyornis*, and the still more ancient *Archæopteryx*, appear both to have had excellent ones.

The disposition of the remiges in their mutual relations is very noteworthy. They have a rigid hollow barrel of great resistant powers, considering the amount of substance, — just like the cylindrical stem of the cereal plant; a stout, solid, highly elastic shaft; the outer web narrower than the inner, with its barbs set at a more acute angle upon the shaft. Any one of these stiffer outer vanes *overlies* the broader and more yielding inner vane of the next outer feather, which, on receiving the impact of air from below, resists as it were with the strength of a second shaft superimposed. Though the "way of an eagle in the air" was a mystery to the wise man of old, the mechanics of ordinary flight are now better understood. But the sailing of some birds for an indefinite length of time, up as well as down, without visible motion of the wings, and without reference to the wind, remains an enigma. The flight of the albatross and turkey vulture, I venture to affirm, is not yet explained. The riddle of The Wing will be read when we know how the archsaurian escaped from ilus to æther.

The *number* of true remiges ranges from about sixteen, as in a humming-bird, to upwards of fifty, as in the albatross. Their *shape* is quite uniform, minor details aside. They are the stiffest, strongest, most perfectly *pennaceous* of feathers, without evident hyporhachis, if any. They are generally *lanceolate*, that is, tapering regularly and gradually to an obtuse point, though not infrequently more parallel-sided, especially those of the secondary and tertiary series. Either or both webs may be incised toward the end; that is, more or less abruptly narrowed; this is called *emargination* (see fig. 279); their ends may be transversely or obliquely truncate, or nicked in various ways. In a few birds, apparently for purposes of sexual ornamentation, they are developed in bizarre shapes of beauty, with evident decrease of utility as flight-feathers. Those of the ostrich and penguin tribes share the peculiarities of the general plumage of these extraordinary birds. Remiges are divided into three classes or series, according to where they grow upon the limb, whether upon the hand, the fore-arm, or the upper arm. In this distinction is involved one of the most important considerations of practical ornithology, of which the student must make himself master. The three classes of quill-feathers are: 1. the *primaries;* 2. the *secondaries;* 3. the *tertiaries*.

The Primaries (Fig. 30, *b*) are those remiges which grow upon the pinion, or hand- and finger-bones collectively (fig. 27, *C* to *D*). Whatever the total number of the remiges may be, *in nearly all birds with true remiges the Primaries are either* NINE or TEN *in number*. The humming-bird with sixteen remiges, the albatross with fifty or more, each have ten primaries. The grebes and a few other birds are said to have eleven primaries: if this be so, it is at any rate highly exceptional. No instance of a higher number than this is known to me. Again, it is only among the highest *Passeres* that the number nine is found, the *Oscines* having indifferently nine or ten. In a good many *Oscines*, rated as nine-primaried, there are actually ten, though the outermost is so rudimentary, and even out of allignment with the developed primaries, that it is not counted as one of them. Among *Oscines*, just this difference of one evident and unquestionable primary more or less forms one of the best distinctions between the families of that suborder. So the tenth feather in a bird's wing, counting from the outside, becomes a crucial test in many cases; for, if it be last primary, the bird is one thing; if it be first secondary, the bird is another. In such cases the necessity, therefore, of determining exactly which it is becomes evident. Of course it is always possible to settle the question by striking at the roots of the remiges and seeing how many are seated on the pinion; but this generally involves some defacing of the specimen, and there is usually an easier way of determining. Hold the wing half-spread: then, in most *Oscines*, the primaries come sloping down on one side, and the secondaries similarly on the other, to form where they

meet a reëntrant angle in the general contour of the posterior border of the wing; the feather that occupies this notch is the one we are after, and unluckily it is sometimes last primary, sometimes first secondary. But observe that primaries are so to speak, *self-asserting, emphatic, italicized,* remiges, stiff, strong, and obstinate; while secondaries are *retiring, whispering, in brevier,* limber, weak, and yielding. Their different character is almost always shown by *something* in their shape or texture which the student will soon learn to recognize, though it cannot well be described. Let him examine fig. 30, where *b* marks the nine primaries of a sparrow's wing, and *s* indicates the secondaries; he will see a difference at once. The primaries express themselves, though with diminishing emphasis, to the last one; then the secondaries begin to tell a different tale. Among North American birds the only ones with NINE primaries are the families *Motacillidæ, Vireonidæ, Coerebidæ, Sylvicolidæ, Hirundinidæ, Tanagridæ, Fringillidæ, Icteridæ,* part of *Vireonidiæ,* and the genus *Ampelis.* The condition of the *first* primary, whether *spurious* or not, is often of great help in this determination. The first primary is called "spurious" when it is very short — say one third, or less, as long as the second, or longest, primary. Among *Passeres,* a spurious first primary only occurs in certain ten-primaried *Oscines:* whence it is evident, that to find such short first primary is equivalent to determining the presence of ten primaries, though not to find it does not prove there are only nine; the count should be made in all cases in which the outer primary is more than one-third as long as the next. The difference between nine primaries, and ten with the first spurious, is excellently illustrated among the species of *Vireo.* Any thrush, nuthatch, titmouse, or creeper shows a spurious primary to advantage, — large enough not to be overlooked, small enough not to be mistaken.

The Secondaries (Fig. 30, *s*) are those remiges which are seated on the fore-arm (fig. 27, *B* to *C*). They vary in number from six to forty or more. They have the peculiarity of being attached to one of the bones of the fore-arm, the *ulna.* If an ulna be examined closely, there will be seen a row of little points showing the attachment; such are indicated in fig. 27, along *ul,* and in fig. 31. The secondaries present no points necessary to dwell upon here, after what has been said of the primaries. They are enormously developed in the Argus pheasant, and have curious shapes in some other exotic birds. They are often long enough to cover the primaries completely when the wing is closed, as in grebes; on the other hand, they are extremely short in the swifts and hummingbirds.

FIG. 31. — Ulna of *Colaptes mexicanus,* showing points of attachment of the secondaries. (Dr. R. W. Shufeldt, U. S. A.)

The Tertiaries (Fig. 30, *t*) are properly the remiges which grow upon the upper arm, *humerus.* But such feathers are not very evident in most birds, and the two or three innermost secondaries, growing upon the very elbow, and commonly different from the rest in form or color, pass under the name of "tertiaries." Again, in some cases, scapular feathers (fig. 30, *scp,*) are called tertiaries, especially when long or otherwise conspicuous. But there is an evident and proper distinction. Scapulars belong to the *pteryla humeralis* (see p. 87); while tertiaries, whether seated on the elbow or higher up the arm, are the innermost remiges of the *pteryla alaris.* These inner remiges are often shortly called *tertials;* though the longer name is more correct, besides being conformable with the names of the other two series of remiges. Tertiaries often afford good characters for description, in peculiarities of their size, shape, or color. Thus it is very common among *Fringillidæ* for these feathers to be parti-colored differently from the other remiges. In many birds they are long and "flowing"; as in the families *Motacillidæ* and *Alaudidæ,* where they reach about to the end of the primaries when the wing is closed. Their development is similar in many *Scolopacidæ.* In

such cases, the feather-border of the wing pronounces the letter **W** quite strongly, — outer lower angle at point of primaries; middle upper angle at reëntrance between primaries and secondaries; inner lower angle at point of tertiaries.

The "point of the wing" is at the tip of the longest primary. It is best expressed when the first primary is longest. Sometimes the end is so much rounded off, that the midmost primary may be the longest one, the others being graduated on both sides of this projecting point. In speaking of the relative lengths of remiges, we always mean the way in which their tips fall together, not the actual total lengths of the feathers. Thus a second primary, whose tip falls opposite the tip of the first one, is said to be of equal length, though it may actually be longer, being seated higher up on the pinion. The development of the primaries also furnishes one of the most important measurements of birds: for the expression "length of wing," or simply "the wing," means the distance from the "bend of the wing," or carpal angle, to the end of the longest primary. The integument of the wing does not very often develop anything but feathers. Occasionally

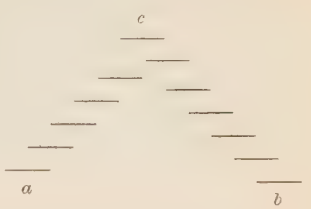
Claws and Spurs are found upon the pinion. Claws have been already noticed (p. 108). They are properly so called, being horny growths comparable in every way to those upon the ends of the toes, like the claws of beasts, or human nails. A *spur* (Lat. *calcar*), however, is something different, though of the same horny texture, since it does not terminate a digital phalanx, but is off-set from the side of the hand. It is exactly like the spur on the leg of a fowl, which obviously is not a claw. The spur-winged goose (*Plectropterus*), pigeon (*Didunculus*), plovers (*Chettusia*, etc.), and the doubly-spurred screamer (*Palamedea*), afford examples of such outgrowths, of which the Jaçanas (*Parra*) furnish the only, though a very well-marked, illustration among North American birds. (See fig. 53 *ter*.)

III. THE TAIL.

Its Bony Basis. — Time was when birds flew about with long, lizard-like, bony and fleshy tails, having the feathers inserted in a row on either side like the hairs of a squirrel's. But we have changed all that *distichous* arrangement since when the *Archæopteryx* was steered with such a rudder through the scenes of its Jurassic life. Now the true separate *coccygeal* bones are few, generally about nine in number, and so short and stunted that they do not project beyond the general plumage, — in fact scarcely beyond the border of the pelvis. Anteriorly, within the bony basin of the pelvis, there are several vertebræ, which, fusing together and with the true *sacrum*, are termed *urosacral* or false tail-bones. To these succeed the true caudal vertebræ, movable upon each other and upon the urosacrum. The last one of these, abruptly larger than the rest, and of peculiar shape, bears all the large tail-feathers, which radiate from it like the blades of a fan. The true caudal vertebræ collectively form the *coccyx* (Gr. κόκκυξ, *kokkux*, a cuckoo; from fancied resemblance of the human tail-bones to a cuckoo's bill); the enlarged terminal one is the *vomer* (Lat. *vomer*, a plough-share, from its shape; not to be confused with a bone of the skull of same name) or *pygostyle* (Gr. πυγή, *puge*, rump, and στῦλος, *stulos*, a stake, pale). The pygostyle, however, is a compound bone, consisting of several stunted coccygeal vertebræ fused in one. The bones are moved by appropriate muscles, and upon the surface is seated the elæodochon (p. 86). The whole bony and muscular affair is familiar to every one as the "pope's nose" of the Christmas turkey; it is a bird's real tail, of which the feathers are merely appendages. In descriptive ornithology, however, the anatomical parts are ignored, the word "tail" having reference solely to the feathers. These, like those of the wings, are of two sorts: the coverts or *tectrices*, and the rudders or *rectrices* (Lat. *rectrix*, pl. *rectrices*, a ruler, guider; because they seem to steer the bird's flight); corresponding exactly to the coverts and remiges of the wings. The

Tail-Coverts are the numerous comparatively small and weak feathers which overlie and underlie the rectrices, covering their bases and extending a variable distance toward their ends, contributing to the firmness and symmetry of the tail. They pass smoothly out from the body, by gradual lengthening, there being seldom, if ever, any obvious outward distinction between them and feathers of the rump and belly; but they belong to the *pteryla caudalis* (p. 87). The natural division of the coverts is into an *upper* and *under* set (*tectrices superiores*, *tectrices inferiores*). The inferior coverts are the best distinguished from the general plumage, the anus generally dividing off these "vent-feathers," as they are sometimes called. It is to the bundle of under tail-coverts, behind the vent, that the term *crissum* is most properly applied. Neither set is ever entirely wanting; but one or the other, particularly the upper one, may be very short, as in a cormorant, or duck of the genus *Erismatura*, exposing the quills almost to their bases. While the upper coverts are usually shorter and fewer than the under ones, reaching less than half-way to the end of the tail, they sometimes take on extraordinary development and form the bird's chiefest ornament. The gorgeous, iridescent, argus-eyed train of the peacock consists of enormous tectrices, not rectrices; the elegant plumes of the paradise trogon, *Pharomacrus mocinno*, several times longer than the bird itself, are likewise coverts. Occasionally, a pair of coverts lengthens and stiffens, and then resembles true tail-feathers; as in the Ptarmigan (*Lagopus*). The crissal feathers are more uniform in development; they ordinarily form a compact, definite bundle, as well shown in a duck, where they reach about to the end of the tail. In some of the storks, they become plumes of considerable pretensions; and in the wonderful humming-bird, *Loddigesia mirabilis*, the middle pair stiffens to resemble rectrices and projects far beyond the true tail. The

Rectrices, **Rudders**, or true tail-feathers, like the remiges or rowers, are usually stiff, well-pronounced feathers, pennaceous to the very base of the vexilla, without after-shafts, as a rule, and with the outer web narrower than the other in most cases. They are always *in pairs;* that is, there is an equal number of feathers on the right and left half of the tail; and their number, consequently, is an even one. The exceptions to this rule are so few and irregular, and then only among birds with the higher numbers of rectrices, that such are probably to be regarded as mere anomalies, from accidental arrest of a feather. They are imbricated over each other in this wise: the central pair are highest, lying with *both* their webs over the next feather on either side, the inner web of one of these middle feathers indifferently underlying or overlying that of the other; all thus successively overlying the next outer one so that they would form a pyramid were they thick instead of being so flat. The arrangement is perceived at once in the accompanying diagram; where it will be seen, also, that *spreading* the tail is the divergence of *a* from *b*, while closing the tail is bringing *a* and *b* together under *c*. The motion is effected by certain muscles that draw on either side upon the bases of the quills collectively; they are the same that pull the whole tail to one side or the other, acting like the tiller-ropes of a boat's rudder. The *general*



Shape of a Rectrix is shown in fig. 23. Such a feather is ordinarily straight, somewhat clubbed or oblong, widening a little, regularly and gradually toward the tip, where it is gently rounded off. But the departures from such shape, or any that could be assumed as a standard, are numberless, and in some cases extreme. In fact, none of a bird's feathers are more variable than those of the tail; it is impossible to specify all the shapes they assume. While most are straight, some are curved — and the curvature may be to or from the middle line of the body, in the horizontal plane, or up and down, in the vertical plane. Some shapes

have received particular names. A rectrix broad to the very tip, and there cut squarely off, is said to be *truncate;* one such cut obliquely off is *incised*, especially when, as often happens, the outline of the cut-off is concave. A *linear* rectrix is very narrow, with parallel sides; a *lanceolate* one is broader at the base, thence tapering regularly and gradually to the tip. A notably pointed rectrix is said to be *acute;* when the pointing is produced by abrupt contraction near the tip, as in most woodpeckers, the feather is *acuminate*. A very long and slender, more or less linear feather is called *filamentous*, as the lateral pair of a barn swallow or most sea swallows. The vanes sometimes enlarge abruptly at the end, forming a spoon-shaped or *spatulate* feather; or such a spoon may result from narrowing of the vanes near the end, or their entire absence, as in the "racket" of a saw-bill (*Momotus*). The vanes are sometimes wavy as if crimped; our *Plotus* is a fine example of this. Sometimes the vanes are entirely loosened, the barbs being remote from each other, as in the exotic genus *Stipiturus*, and some parts of the wonderful caudal appendage of the male lyre-bird (*Menura superba*). When the rhachis projects beyond the vanes, the feather is *spinose*, or better, *mucronate* (Lat. *mucro*, a pricker), as excellently shown in the chimney-swift, *Chætura* (fig. 297). A pair of feathers abruptly extending far beyond the others are called *long-exserted*, after the analogous use of the term in botany. Tail-feathers also differ much in their consistency, from the softest and weakest, not well distinguished from coverts, to such stiff and rugged props as the woodpeckers possess. They are downy and very rudimentary in a few birds, notably all the grebes, *Podicipedidæ*, which are commonly said to have no tail. The tinamous of South America (*Dromæognathæ*) are also very closely docked. The

FIG. 32. — The Lyre-bird of Australia, *Menura superba*, to show the unique *lyrate* shape of the tail. (From Amer. Nat.)

Typical Number of Rectrices is *twelve*. This holds in the great majority of birds. It is so uniform throughout the great group Oscines, that the rare exceptions seem perfectly anomalous. In the other group of *Passeres* (*Clamatores*) it is usually twelve, sometimes ten. Ten is the rule among *Picariæ*, though many have twelve, a very few only eight, as in the genus *Crotophaga*. The whole of the woodpeckers (*Picidæ*) have *apparently ten;* but really

twelve, of which the outer one on each side is spurious, very small, and hidden between the bases of the second and third feathers. Birds of prey (*Raptores*) have about twelve. In pigeons the rule is twelve or fourteen, as in all our genera; but sixteen are found in some and twenty in one case. In birds below these, the number increases directly; there are often or usually more than twelve in the grouse, and there may be sixteen, eighteen, or twenty, as among our own genera of *Tetraonidæ*. Wading birds, often having but twelve, furnish instances of as many as twenty. Those swimming birds with large well-formed tails, as the *Longipennes*, and some *Anatidæ*, have the fewest, as twelve, sometimes fourteen, rarely sixteen; those with short soft tails have the most, as sixteen to twenty-four. Among the penguins there are thirty-two or more. The *Archæopteryx* appears to have had forty, — a pair to each free caudal vertebra; and this may be considered the prototypic relation between the bones and feathers of the tail. The

Typical Shape of the Tail, as a whole, is the *fan*. The modifications of form, however, which are greater and more varied than those of the wing, are susceptible of better definition, and many of them have received special names. Taking the simplest case, where the rectrices are all of the same length, we have what is called the *even*, *square*, or *truncate* tail. The other forms depart from this mainly by shortening or lengthening of certain feathers. A tail nearly or quite even may have the two central feathers long-exserted, as seen in the jaegers (*Stercorarius*), and tropic-birds (*Phaëthon*). The most frequent departure from the even shape results from gradual shortening of successive rectrices from the middle to the outer ones. This is called, in general, *gradation* or *graduation* (Lat. *gradus*, a step); such shortening may be to any degree. More precisely, graduation means shortening of each successive feather to the same extent, — say, each half an inch shorter than the next; but such exactitude is not often expressed. When the feathers shorten by more and more, we have the true *rounded* tail, probably the commonest form among birds; thus, the gradation between the middle and next pair may be just appreciable, and then increase regularly to an inch between the next and the lateral feather. The opposite gradation, by less and less shortening, gives the wedge-shaped or *cuneate* (Lat. *cuneus*, a wedge) tail; it is well shown by the magpie (*Pica*) in which, as in many other birds, the middle feathers would be called long-exserted were the rest all as short as the outer one is. A cuneate tail, especially if the feathers be narrow and lanceolate, is also called *acute*, or pointed, as in the sprig-tailed duck (*Dafila*) or sharp-tailed grouse (*Pediœcetes*). The generic opposite of the gradated is the *forked* tail; in which the lateral feathers successively increase in length from the middle to the outermost pair. The least appreciable forking is called *emargination*, and a tail thus shaped is said to be *emarginate*; when it is better marked, as, for instance, an inch of forking in a tail six inches long, the tail is truly *forked* or *furcate* (Lat. *furca*, a fork). But the degrees of furcation, like those of gradation, are so insensibly varied, that qualified expressions are usual; as, "slightly forked," "deeply forked." Deep furcation is usually accompanied by more or less narrowing or filamentous elongation of the lateral pair of rectrices, as in the barn swallows (*Hirundo*) and most of the sea-swallows (*Sterna*). An advisable term to express such an extreme furcation is *forficate* (Lat. *forfex*, scissors), when the depth of the fork is at least equal to the length of the shortest feathers; it occurs among our birds in those last named, in the species of the flycatcher genus *Milvulus*, and elsewhere. *Double-forked* and *double-rounded* tails are not uncommon; they result from combination of both opposite gradations, in this way: The middle feathers being of a certain length, the next two or three pairs progressively increasing in length, and the rest successively decreasing, the tail is evidently forked centrally, rounded externally, which is the double-rounded form, each half of the tail being rounded; it is shown in the genera *Myiadestes* and *Anous*. Now if with middle feathers as before, the next pair or two decrease in length, and then the rest increase to the outermost, we have

the double-forked, a common style among sandpipers, as if each half of the tail were forked. But in such case, the forking is slight, merely emargination, being little more than protrusion of the middle pair of feathers in an otherwise lightly forked tail; and in the double-rounded form the gradation is seldom if ever great.

I should also allude to shapes of tail resulting from the relative positions of the feathers. Prominent among these is the *complicate* or *folded* tail of the barn-yard fowl, and others of the *Phasianidæ*, — a very familiar but not common form. It is only retained while the tail is closed and cocked up, — for when it is lowered and spread in flight it flattens out. The opposite disposition of the feathers is seen to some extent in our crow blackbirds (*Quiscalus*), where the lateral feathers slant upward from the lowermost central pair, like the sides of a boat from its keel; this is the *scaphoid* (Gr. σκάφη, a boat) or *carinate* (Lat. *carina*, a keel) tail. Our "boat-tailed" grackle has been so named on this account. One of the most beautiful and wonderful of all the shapes of the tail is illustrated by the male of the lyre-bird (*Menura superba*, fig. 32), in which the feathers are anomalous both in shape and in texture, and the resulting form of the whole is unique. Various shapes, which the student will readily name from the foregoing paragraphs, are illustrated in many other figures of this work. It should be remembered that, to determine the shape, the tail should be *nearly* closed; for spreading will obviously make a square tail round, an emarginate one square, etc. I append a diagram of the principal forms (fig. 33).

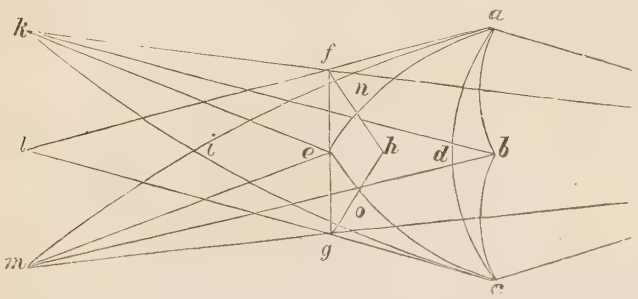


FIG. 33. — Diagram of shapes of tail. *adc*, rounded; *aec*, gradate; *aic*, cuneate-gradate; *alc*, cuneate; *abc*, double-rounded; *feg*, square; *fhg*, emarginate; *fneog*, double-emarginate; *kim*, forked; *kem*, deeply forked; *kbm*, forficate.

IV. THE FEET.

The Hind Limbs, in all birds, are organized for progression — all can walk, run, or hop on land, though the power to do so is very slight in some of the lower swimming birds, as loons and grebes, and certain of the lower perching birds, as hummers, swifts, goatsuckers, and kingfishers. They are specially fitted for perching on trees, bushes, and other supports requiring to be grasped, in the great majority of birds, as throughout the *Passeres*, *Picariæ*, *Accipitres*, *Columbæ*, and, in fact, many water-birds; there being few forms, mainly found among three-toed birds, or those in which the hind toe is short, weak, and elevated, in which the extremity of the limb has not decided grasping power. The limb becomes a paddle for swimming either on or in the water in many cases. In not a few, as parrots and birds of prey, the foot is serviceable as a hand. Those kinds of birds which live in trees and bushes habitually progress, even when on level ground, in a series of hops, or rather leaps, both feet being moved together: in all the lower birds, however, the feet move one after the other, as in ordinary walking or running. The modifications of the hind limb are more numerous, more diverse, and more important in their bearing on classification than those of either bill, wing, or tail; their study is consequently a matter of special interest.

Their Bony Framework (fig. 34). — Beginning at the hip-joint, and ending at the extremities of the several toes, the skeleton of the hind limb consists in the vast majority of adult birds of *twenty* bones. This is the typical and nearly the average number; birds

scarcely ever have more, and the principal lessenings of the number result from the absence of one or two toes, or a slight reduction in the number of the joints of some toes, or absence of the knee-cap. Of the normal twenty, fourteen are bones of the toes; one is an incomplete bone connecting the hind toe with the foot; one is the knee-cap, and four are the principal bones of the thigh (1), leg (2), and foot (1). The first or uppermost is the thigh-bone or *femur* (Lat. *femur;* adjective, *femoral*), *fm*, from hip to knee, *A* to *B* in the figure. It is a rather short, quite stout, cylindrical bone, enlarging above and below. Above it has a globular head, *a*, standing off obliquely from the shaft, received in the *acetabulum* (Lat. *acetabulum*, a kind of receptacle) or socket of the hip, and a prominent shoulder or *trochanter*, which abuts against the brim of the acetabulum. Below, it expands into two *condyles* (Gr. κόνδυλος, a knob), for articulation with both the bones it meets at the knee. It is the same bone as the femur of a quadruped or of man, and corresponds to the *humerus* of the wing. In the knee-joint, many or most birds have a small ossicle, and a few have two such bony nodules, not shown in the figure, but nearly in the position of the letter *B:* the knee-pan or knee-cap, *patella* (Lat. *patella*). The thigh is the first *segment* of the limb; the next segment is the leg proper, or *crus* (Lat. *crus*, the shin; adjective, *crural*), *B* to *C* in the figure, or from knee to heel. This segment is occupied by two bones, the *tibia* (Lat. *tibia*, a tube, trumpet), *tb*, and *fibula* (Lat. *fibula*, a splint, clasp), *fi*. Of these the tibia is the principal, larger, inner bone, running quite to the heel; the fibula is smaller, and (with rare exceptions, as in some of the penguins) only runs part way down the outside of the tibia as a slender pointed spike, close pressed against or even partly fused with the shaft of the tibia. Above, at the knee, both bones articulate with the femur; the tibia with both the femoral condyles, the fibula only with the outer condyle. Above, the tibia has an irregularly expanded head or *cnemial* process (Gr.

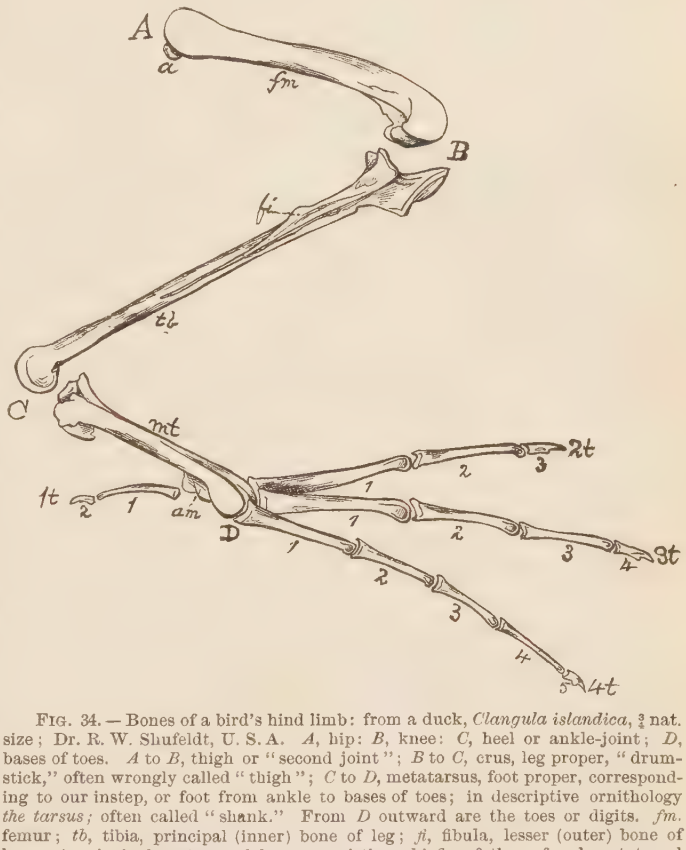


FIG. 34. — Bones of a bird's hind limb: from a duck, *Clangula islandica*, ⅔ nat. size; Dr. R. W. Shufeldt, U. S. A. *A*, hip: *B*, knee: *C*, heel or ankle-joint; *D*, bases of toes. *A* to *B*, thigh or "second joint"; *B* to *C*, crus, leg proper, "drumstick," often wrongly called "thigh"; *C* to *D*, metatarsus, foot proper, corresponding to our instep, or foot from ankle to bases of toes; in descriptive ornithology *the tarsus;* often called "shank." From *D* outward are the toes or digits. *fm*, femur; *tb*, tibia, principal (inner) bone of leg; *fi*, fibula, lesser (outer) bone of leg; *mt*, principal metatarsal bone, consisting chiefly of three fused metatarsal bones; *am*, accessory metatarsal, bearing 1*t*, first or hind toe, with two joints; 2*t*, second toe, with three joints; 3*t*, third toe, with four joints; 4*t*, fourth toe, with five joints. At *C* there are in the embryo some small tarsal bones, not shown in the figure, uniting in part with the tibia, which is therefore a *tibio-tarsus*, in part with the metatarsus, which is therefore a *tarso-metatarsus;* the ankle-joint being therefore between two rows of tarsal bones, not, as it appears to be, directly between tibia and metatarsus

κνήμη, *kneme*, same as Lat. *crus*), which in some birds, as loons, runs high up in front above the knee-joint. Below, the tibia alone forms the ankle-joint, *C*, by articulating with the next bone. For this purpose it ends in an enlarged *trochlear* (Gr. τροχαλία), or pulley-like surface, presenting a little forward as well as downward, above which, in many birds, there is a little bony bridge beneath which tendons passing to the foot are confined. This finishes the leg, consisting of thigh, *A B*, and leg proper, *B C*, bringing us to the ankle-joint at the heel, *C*.

Now a bird's legs, unlike ours, are not separate from the body from the hip downward; but, for a variable distance, are enclosed within the general integument of the body. The freedom of the limb is greatest among the high perching birds, and especially the *Raptores*, which use the feet like hands, and least among the lowest swimmers. The range of variation, from greatest freedom to most extensive enclosure of the limb, is from a little above *B* nearly to *C*, as in the case of a loon, grebe, or penguin. In no bird is the knee, *B*, seen outside the general contour of the plumage: it must be looked or felt for among the feathers, and in most prepared skins will not be found at all, the femur having been removed. It is a point of little practical consequence, though bearing upon the generalization just made. The first *joint*, or bending of the limb, that appears beyond a bird's plumage is the *heel*, *C*; and this is what, in loose popular parlance, is called "knee," upon the same erroneous notions that make people call the wrist of a horse's fore-leg "knee." People also call a bird's *crus* or leg proper, *B* to *C*, the "thigh," and disregard the true thigh altogether. This confusion is inexcusable; any one, even without the slightest anatomical knowledge, can tell knee from heel at a glance, whatever their respective positions relative to the body. *Knee* is at junction of thigh and leg proper; it always *bends forward; heel* is at junction of leg with foot, and always bends backward. This is as true of a bird, which is *digitigrade*, that is, walks on its toes with its heels in the air, as it is of a man, who is *plantigrade*, that is, walks on the whole sole of the foot, with the heel down to the ground. In a carver's language, the thigh is the "second joint" (from below); the leg is the "drumstick"; the rest of a fowl's hind limb does not usually come to table, having no flesh upon it. (See frontispiece, *Th, Kn, Lg.*)

Before proceeding to the next segment of the limb, I must dwell upon the ankle-joint, situated at the heel, — the point *C*, — corresponding to the carpal angle or bend of the wing, *C*, in fig. 27. There we found, in adult birds, two small carpal bones, or bones of the wrist proper; and noted the presence in the embryo of several other carpals (fig. 29), which early fuse with the metacarpus. Just so in the ankle, there are in embryonic life several *tarsal* bones, or bones of the *tarsus* (Lat. *tarsus*, the ankle); *all* of which, however, soon disappear, so that there appears to be no tarsus, or collection of little bones between the tibia and the next segment of the limb, the *metatarsus*. An upper tarsal bone, or series of tarsal bones, fuses with the lower end of the tibia, making this leg-bone really a *tibio-tarsus*; and similarly, a lower bone or set of bones fuses with the upper end of the metatarsus, making this bone a *tarso-metatarsus*. So there are left no free bones in the ankle-joint, which thus appears to be immediately between the leg-bone and the principal foot-bone; but which is nevertheless really between two series of tarsal bones, the identity of which has been lost.[1]

[1] The exact homologues of a bird's vanishing tarsal bones are still questioned. Gegenbaur showed the so-called epiphysis or shoe of bone at the foot of the tibia, and the similar cap of bone on the head of the principal metatarsal bone, to be true tarsal elements. Morse went further, showing the tibial epiphysis, or upper tarsal bone of Gegenbaur to be really two bones, which he held to correspond with the tibiale and fibulare, or *astragalus* and *calcaneum* of mammals; these subsequently combining to form the single upper tarsal bone of Gegenbaur, and finally becoming anchylosed with the tibia to form the bitrochlear condylar surface so characteristic of the tibia of *Aves*. The distal tarsal ossicle he believed to be the *centrale* of reptiles. Wyman discovered the so-called "process of the astragalus" to have a distinct ossification, and Morse interpreted it as the *intermedium* of reptiles. Later views, however, as of Huxley and Parker, limit the tibial epiphysis to the *astragalus* alone of mammals. If these opinions be correct, other tarsal elements (more than one) are to be looked for in the epiphysis of the metatarsus. Whatever the final determination of these obscure points may be, it is certain that, as said in the text above, the lower end of a bird's tibia and the upper end of a bird's metatarsus include true tarsal elements, just as the upper

The next segment of the limb, *C* to *D*, or the foot proper, is represented by the principal *metatarsal* bone, *mt.* This corresponds to the human *instep* or arch of the foot, nearly from the ankle-joint quite to the roots of the toes. The metatarsal bone, like the metacarpal of the hand, which it represents in the foot, is a compound one. Besides including the evanescent tarsal element or elements already specified, it consists of *three* metatarsal bones consolidated in one, just as the metacarpal is tripartite. Among recent birds, the three are partly distinct only in the penguins; but in all, excepting ostriches, the original distinction is indicated by three prongs or stumps at the lower end of the bone, forming as many articular surfaces for the three anterior toes. The other toe most birds possess, the hind toe, is hinged upon the metatarsus in a different way, by means of a small separate metatarsal bone, quite imperfect; this is the *accessory metatarsal*, *am.* It is situated near the lower end toward the inner side of the principal metatarsal bone, and is of various shapes and sizes; it has no true jointing with the latter, but is simply pressed close upon it, much as the fibula is applied to the tibia, or partly soldered with it. Above, it is defective; below, it bears a good facet for articulation with the hind toe. ☞ In spite of anatomical proprieties, the metatarsal part of a bird's foot — from heel to base of toes — from *C* to *D*, is in ordinary descriptive ornithology *invariably* called "*The Tarsus*"; a wrong name, but one so firmly established that it would be finical and futile to attempt to substitute the correct name. In the ordinary attitude of most birds, it is held more or less upright, and seems to be rather "leg" than a part of the "foot." It is vulgarly called "the shank." These points must be ingrained in the student's mind to prevent confusion. (See fig. 112 *bis*, p. 229.)

The *digits* of the foot, or *toes*, upon which alone most birds walk or perch, consist of certain numbers of small bones placed end to end, all jointed upon one another, and the basal or proximate ones of each toe separately jointed either with the principal or the accessory metatarsal bone. Like those of the fingers, these bones are called *phalanges* (Lat. *phalanx*, a rank or series) or *internodes* (because coming between any two joints or nodes of the toes). The furthermost one of each almost invariably bears a nail or claw (*unguis*). The phalanges are of various relative lengths, and of a variable number in the same or different toes. But all these points, being matters of descriptive ornithology rather than of anatomy proper, are fully treated beyond, as is also the special horny or leathery covering of the feet usually existing from the point *C* outward. We may here glance at the

Mechanism of these Bones. — The hip is a ball-and-socket joint, permitting round-about as well as fore-and-aft movements of the whole limb, though more restricted than the shoulder-joint. The knee is usually a strict *ginglymus* (Gr. γίγγλυμος, *gigglumos*, hinge) or hinge-joint, allowing only backward and forward motion; and so constructed that the forward movement of the leg is never carried beyond a right line with the femur, while the backward is so extensive that the leg may be quite doubled under the thigh. In some birds there is a slight rotatory motion at the knee, very evident in certain swimmers, by which the foot is thrown outward, so that the broad webbed toes may not "interfere." The heel or ankle-joint is a strict hinge; its bendings are just the reverse of those of the knee; for the foot cannot pass back of a right line with the leg, but can come forward till the toes nearly touch the front of the knee. In some birds the details of structure are such that, with the assistance of certain muscles, the foot is *locked* upon the leg when completely straightened out, so firmly that some little muscular effort is required to overcome the obstacle; birds with this arrangement sleep securely standing on one leg, which is the design of the mechanism. The jointing of the toes with the prongs of the metatarsus is peculiar; for the articular surfaces are so disposed in a certain obliquity, that when

end of the metacarpus includes carpal elements; and that a bird's ankle-joint is *not* tibio-tarsal or between leg-bone and foot-bones, as in mammals, but between proximal and distal series of tarsal bones, and therefore *medio*-tarsal, as in reptiles.

the toes are brought forwards, at right angles or thereabouts with the foot, they spread apart from each other automatically in the action, and the diverging toes of the foot thus opened are pressed upon the ground or against the water. When the toes are bent around in the opposite direction, they automatically come together and lie in a bundle more or less parallel with one another, besides being each bent or flexed at their several nodes. The mechanism is best marked in the swimmers, which, for advantageous use of their webbed toes, must present a broad surface to the water in giving the backward stroke, and bring the foot forward with the toes closed, presenting only an edge to the water,—all on the principle of the feathering of oars in rowing. It is carried to an extreme in a loon, where, when the foot is closed, the digit marked 2*t* in the figure lies below and behind 3*t*. It is probably least marked in birds of prey, which give the clutch with their talons spread. The jointings of the individual phalanges of the toes upon one another are simple hinges, permitting motion of extension to a right line or a little beyond in some cases, with very free flexion in the opposite direction. On the whole, the mechanics of a bird's foot are less peculiar than those of the wing, and quite those of the limbs of a quadruped.

In ordinary hopping, walking, and running, and in perching as well, only the toes rest upon or grasp the support, from *D* to beyond, *C* being more or less vertically over *D*. Such resting of the toes is complete for 2 *t*, 3 *t*, 4 *t* in the figure, or for all the anterior toes; but for the hind toe it varies according to the length and position of that digit, from complete incumbency, like that of the front toes, to mere touching of the tip of that toe, or not even this: the hind toe is then sure to be functionless. But many of the lower birds, such as loons and grebes, cannot stand at all upright on their toes, resting with the heel touching the ground; and in many such cases the tail furnishes additional support, making a tripod with the feet, as in the kangaroo. Such birds might be called *plantigrade* (Lat. *planta*, the sole; *gradus*, a step) in strict anatomical conformity with the quadrupeds so designated. The others are all *digitigrade*, standing or walking on their toes alone. But no birds progress on the ends of their toes, or toe-nails, as hoofed quodrupeds do. A bird's ordinary walking or running is the same as ours, so far as the ordinary mechanics of the motions are concerned; but its so-called "hopping" is really leaping, both legs moving at once. Most birds, down to *Columbæ*, leap when on the ground, a mode of progression characteristic of the higher orders; but many of the more terrestrial *Passeres* and *Accipitres* progress by ordinary walking when on the ground, as is invariably the case with parrots, pigeons, gallinaceous birds, and all waders and swimmers.

The student need scarcely be reassured that, whatever their modifications, their relative development, motions, and postures, the several segments of both fore and hind limbs of any vertebrate, quadruped or biped, feathered or featherless, are fixed in one morphologically identical series, thus: 1, shoulder or hip-joint; 2, upper arm or thigh, humerus or femur; 3, elbow or knee-joint; 4, fore-arm or leg proper, radius and ulna or tibia and fibula; 5, wrist, bend of wing, carpus, or heel, ankle, tarsus; 6, hand proper, metacarpus, or foot proper, metatarsus; 7, digits with their phalanges, of hand or foot, fingers or toes. 2, first segment; 4, second segment; 5, third segment (not separate in foot of bird); 6 and 7, fourth segment, in the wing called manus or pinion, in the leg, pes. Observe the improper naming of parts, in the case of the hind limb, whereby 1, 2, 3, are not generally counted; 4 is called "thigh"; 5 is called "knee"; 6 is called "leg" or "shank"; 7 is called "foot." Observe also that in descriptive ornithology 6 is "*the tarsus*."

The Plumage of the Leg and Foot varies within wide limits. In general, the leg is feathered to the heel, *C*, and the rest of the limb is bare of feathers. The thigh is *always* feathered, as part of the body plumage (*pteryla femoralis*). The crus or leg proper (thigh of vulgar language, *B* to *C*) is feathered in nearly all the higher birds, and in swimming birds without exception; in the loons, the feathering even extends on the heel-joint. It is among

the walking and especially the wading birds that the crus is most extensively denuded; it may be naked half-way up to the knee. A few waders, — among ours, chiefly in the snipe family, — have the crus apparently clothed to the heel-joint; but this is due, in most if not all cases, to the length of the feathers, for probably in none of them does the pteryla cruralis itself extend to the joint. Crural feathers are nearly always short and inconspicuous; but sometimes long and flowing, as in the "flags" of most hawks, and in our tree-cuckoos. The *tarsus* (I now and hereafter use the term in its ordinary acceptation — *C* to *D* in fig. 34; *trs* in fig. 36) in the vast majority of birds is entirely naked, being provided with a horny or leathery sheath of integument like that covering the bill. Such is its condition in the *Passeres* and *Picariæ* (with few exceptions, as among swifts and goatsuckers); in the waders without exception, and in nearly all swimmers (the frigate-bird, *Tachypetes*, has a slight feathering). The *Raptores* and *Gallinæ* furnish the most feathered tarsi. Thus, feathered tarsi is the rule among owls (*Striges*); frequent, either partial or complete, in hawks and eagles, as in *Aquila*, *Archibuteo*, *Falco*, *Buteo*, etc. All our grouse, and perhaps all true grouse, have the tarsus more or less feathered (fig. 35). The *toes* themselves are feathered in a few birds, as several of the owls, and all the ptarmigans (*Lagopus*). Partial feathering of the tarsus is often continued downward, to the toes or upon them, by sparse modified feathers in the form of bristles; as is well shown in the barn-owl (fig. 47). When incomplete, the feathering is generally wanting behind and below, and it is almost invariably continuous above with the crural plumage. But in that spirit of perversity in which birds delight to prove every rule we establish by furnishing exceptions, the tarsus is sometimes partly feathered discontinuously. A curious example of this is afforded by the bank-swallow, *Cotile riparia*, with its little tuft of feathers at the base of the hind toe; and some varieties of the barn-yard fowl sprout monstrous leggings of feathers from the side of the tarsus.

FIG. 35. — Feathered tarsus of a grouse, *Cupidonia cupido*. Nat. size.

The Length of Leg, relatively to the size of the bird, is extremely variable; a thrush or sparrow probably represents about average proportions of the limb. The shortest-legged bird known is probably the frigate-pelican, *Tachypetes*; which, though a yard long more or less, has a tibia not half as long as the skull, and a tarsus under an inch. The leg is very short in many Picarian birds, as hummers, swifts, goatsuckers, kingfishers, trogons, etc., in many of which it scarcely serves at all for progression. Among *Passeres*, the swallows resemble swifts in shortness of their hind limbs. It is pretty short likewise in many zygodactyle, yoke-toed or scansorial birds, as woodpeckers, cuckoos, and parrots. In most swimming birds the limb may also be called short, especially in its femoral and tarsal segments; while the broad-webbed toes are comparatively longer. The leg lengthens in the lower perching birds, as many hawks and some of the terrestrial pigeons; it is still longer among walkers proper, such as the gallinaceous birds, and reaches its maximum among the waders, especially the larger ones, such as cranes, herons, ibises, storks, and flamingoes; among all of which it is correlated with extension of the neck. Probably the longest-legged of all birds for its size is the stilt (*Himantopus*). Taking the tarsus alone as an index of length of the whole limb, this is in the frigate under one-thirty-sixth of the bird's length; a flamingo, four feet long, has a tarsus a foot long: a stilt, fourteen inches long, one of four inches: so that the maximum and

minimum lengths of tarsus are nearly thirty and under three per cent. of a bird's whole length.

The Horny Integument of the Foot requires particular attention. That part of the limb which is devoid of feathers is covered, like the bill, by a hardened, thickened, modified integument, varying in texture from horny to leathery. This sheath is called the *podotheca* (Gr. *πούς, ποδός, pous, podos*, foot, and *θήκη, thekē*, sheath). It is more corneous in land birds, and in water birds more leathery: this general distinction has but few exceptions. The perfectly horny envelope is tight, and more validly fixed or nearly so, while the skinny styles of sheath are looser, and may usually be slipped about a little. The integument may differ on different parts of the same leg, and in fact generally does so to some extent. Unlike the sheath of the bill, the podotheca is never simple and continuous, being divided and subdivided in various ways. The lower part of the crus, when naked, and the tarsus and toes, always have their integument cut up into scales, plates, tubercles, and other special formations, which have received particular names. The manner and character of such divisions are often of the utmost consequence in classification, especially among the higher birds, since they are quite significant of genera, families, and even some larger groups.

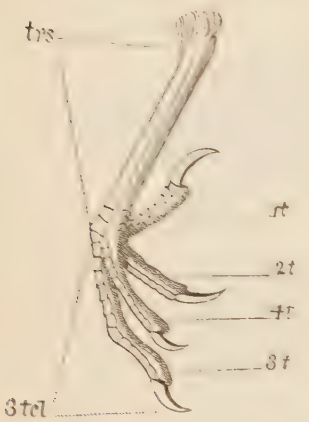


FIG. 36. — Booted laminiplantar tarsus of a robin. Nat. size

FIG. 37. — Scutellate laminiplantar tarsus of a cat-bird. Nat. size.

FIG. 38 — *a*. Reticulate tarsus of a plover. Nat. size. *b*. Scutellate and reticulate tarsus of a pigeon. Nat. size.

The commonest division of the podotheca is into *scales* or *scutella* (Lat. *scutellum*, a little shield: pl. *scutella*, not *scutellæ* as often written): figs. 37, and 38, *b*. These are generally of large comparative size, arranged in definite vertical series up and down the tarsus and along the toes, and apt to be somewhat imbricated, or fixed shingle-wise, the lower edge of one overlapping the upper edge of the next. The great majority of birds have such scutella. They oftenest occur on the front of the tarsus (or *acrotarsium*, corresponding to our "instep"), and almost invariably on the tops of the toes (collectively called *acropodium*): frequently also on the sides and back of the tarsus or *planta*: not so often on the crus, and rarely if ever on the sides and under surfaces of the toes. A tarsus so disposed as to its podotheca is said to be *scutellate*, — scutellate before (fig. 37), or behind, or both, as the case may be. The term is equally applicable to the acropodium, but is not so often used because scutellation of the upper sides of the toes is so universal as to be taken for granted unless the contrary condition is expressly said. The most notorious case of the *Ozena podotheca* figs. 36, 37, characterizing that great group of birds, is given beyond (next paragraph).

Plates, or *reticulations* (Lat. *reticulum*, a web: fig. 38, *a*) result from the cutting up of

the envelope in various ways by cross lines. Plates are of various shapes and sizes, and grade usually into true scutella, from which however they are generally distinguished by being smaller, or of irregular contour, or not in definite rows, or lacking the appearance of imbrication; but there is no positive distinction. They are oftenest *hexagonal* (six-sided), a form best adapted to close packing, as shown very perfectly in the cells of the honey-bee's comb; but they may have fewer sides, or be *polygonal* (many-sided), or even circular; when crowded in one direction and loosened in another the shape tends to be oval or even linear. A leg so furnished is said to be *reticulate:* the reticulation may be entire, or be associated with scutellation, as often happens (fig. 38,* *b*). A particular case of reticulation is called *granulation* (Lat. *granum*, a grain): when the plates become elevated into little tubercles, roughened or not. Such a leg is said to be *granular*, *granulated*, or *rugose:* it is well shown by parrots, and the fish-hawk (*Pandion*). When the harder sorts of scales or plates are roughened without obvious elevation, the leg is said to be *scabrous* or *scarious* (Lat. *scabrum*, a scab). But *scabrous* is also said of the under surfaces of the toes, when these develop special *pads*, or wart-like bulbs (called *tylari*): as is well shown in the sharp-shinned and many other hawks. The softer sorts of legs, and especially the webs of swimming birds, are often marked crosswise or *cancellated* with a lattice work of lines, these however not being strong enough to produce plates; it is more like the lines seen on our palms and finger-tips. The plates of a part of the leg occasionally develop into actual *serrations;* as witnessed along the hinder edge of a grebe's tarsus. When an unfeathered tarsus shows *no* divisions of the podotheca in front (along the acrotarsium), or only two or three scales close by the toes, it is said to be *booted* or *greaved;* and such a podotheca is *holothecal* (Gr. ὅλος, *holos*, whole, entire, and θήκη; fig. 36). The generic opposite is *schizothecal* (Gr. σχίζω, I cleave), whether by scutellation or reticulation or in any other way the integument may be cut up. A booted or holothecal tarsus chiefly occurs in the higher *Oscines*, and is supposed by many, particularly German ornithologists, to indicate the highest type of bird structure. It is, however, found in a few water birds, as Wilson's stormy petrel and other species of *Oceanites*. It is not a common modification. Exceptions aside, it only occurs in connection with an equally particular condition of the *sides and back* of the tarsus, or *planta*. In almost all *Oscine Passeres* (*Alaudidæ* are an exception), which constitute the great bulk of the large order *Passeres*, the planta is covered with one pair of plates or *laminæ*, one on each side, meeting behind in a sharp ridge; a condition called *laminiplantar*, in distinction from the opposite, *scutelliplantar*, state of the parts. A holothecal podotheca only occurs in connection with the laminiplantar condition, the combination resulting in the perfect "boot." Among North American birds, the genus *Oceanites* aside, it is exhibited by the following genera, and by these only: *Turdus*, *Cinclus*, *Saxicola*, *Sialia*, *Regulus*, *Cyanecula*, *Phylloscopus*, *Chamæa*, *Myiadestes;* and even birds of these genera, when *young*, show scutella which disappear with age by progressive fusion of the acrotarsial podotheca. (Compare figs. 36, 37.)

The Crus, when bare of feathers below, may, like the tarsus, be scutellate or reticulate before or behind, or both; such divisions of the crural integument being commonly seen in long-legged wading birds. Or, again, this integument may be loose, softish, and movable, not obviously divided, and passing directly into ordinary skin.

The Tarsus, in general, may be called subcylindrical: it is often quite circular in cross-section; generally thicker from before backward, and only rarely wider from one side to the other than in the opposite direction; but such a shape as this last is exhibited by the penguins. When the transverse thinness is noticeable, the tarsus is said to be *compressed;* and such compression is very great in a loon, in which the tarsus is almost like a knife blade. Quite cylindrical tarsi occur chiefly when there are similar scales or plates before and behind, as

happens in the larks (*Alaudidæ*) : they are rare among land birds, common among waders. Those swimming birds with a very thin skinny podotheca are apt to show traces of the four-sidedness of the metatarsal bone. The tarsus in the vast majority of land birds is seen on close inspection to be somewhat ovate or drop-shaped on cross-section, — gently rounded in front, more compressed laterally, and sharp-ridged behind. This results from the *laminiplantation* described above, and is equally well exhibited by most passerine birds, whether they have booted or anteriorly scutellate tarsi. The line of union of anterior scutella with postero-lateral plates on the sides of the tarsus is generally in a straight vertical line, — either a mere line of flush union, or a ridge, or oftener a groove (well seen in the crows), which may or may not be filled in with a few small narrow plates. In the Clamatorial *Passeres*, represented by our flycatchers, the tarsus is enveloped in a scroll-like podotheca of irregularly arranged plates, the edges of the scroll meeting along the inner side of the tarsus. But the full consideration of special states of the tarsal envelope, however important and interesting, would be part of a systematic treatise on ornithology, rather than of an outline sketch like this.

The Number of Toes (individually, *digiti ;* collectively, *podium*) is *four:* there are *never* more. There are *two* in the ostrich alone, in which both inner and hind toe are wanting. There are three in all the other struthious birds (*Rheidæ*, *Casuariidæ*), excepting *Apteryx*, which has four. There are likewise three, the hind toe being suppressed, in the tinamine genera *Calodromas* and *Tinamotis* (*Dromæognathæ*) ; throughout the auk family (*Alcidæ*) ; in the petrel genus *Pelecanoïdes;* apparently in the albatrosses (*Diomedeinæ*) ; usually in the gull genus *Rissa ;* in the flamingo genus *Phœnicoparra ;* throughout the bustard family (*Otididæ*), and among various related forms, as *Œdicnemus*, *Esacus*, *Cursorius ;* in the plovers (*Charadriidæ*), excepting *Squatarola ;* and in the bush-quails (*Turnicidæ*), excepting *Pedionomus*. In higher birds, three toes are a rare anomaly, only known to occur in three genera of woodpeckers (*Picoïdes*, *Sasia*, and *Tiga*), and in one galbuline genus (*Jacamaralcyon*), by loss of the hind toe : in two genera of kingfishers (*Ceyx* and *Alcyone*), by suppression of the inner front toe ; and in the passerine genus *Cholornis*, by defect of the outer front toe. North American three-toed birds are these only : the woodpeckers of the genus *Picoïdes ;* all auks (*Alcidæ*), and albatrosses (*Diomedeinæ ;* in these, however, there is a rudiment of the hind toe) ; all plovers (*Charadriidæ*, excepting one, *Squatarola*) ; the oyster-catchers (*Hæmatopus*) ; the sanderling (*Calidris*, fig. 39) ; the stilt (*Himantopus*). Birds with two toes are said to be *didactyle :* with three, *tridactyle :* with four, *tetradactyle*. In the vast majority of cases, birds have *three* toes in front and *one* behind. Occasionally, either the hind toe, or the outermost front toe, is *versatile*, that is, susceptible of being turned either way. Such is the condition of the outer front toe in most owls (*Striges*), and in the fish-hawk (*Pandion*). We have no case of true versatility of the hind toe among North American birds; but several cases of its stationary somewhat lateral position, as in goatsuckers (*Caprimulgidæ*), some of the swifts (*Cypselidæ*), the loons (*Colymbidæ*), and all the totipalmate swimmers (*Steganopodes*). Nor have we any example of that rarest of all conditions (seen in some *Cypselidæ*, and the African *Coliidæ*) in which *all four* toes are turned forward. The arrangement of toes *in pairs*, two before and two behind, is quite common, being the characteristic of scansorial birds and some others, as all the parrots and woodpeckers, cuckoos, trogons, etc. Such arrangement is called *zygodactyle* or *zygodactylous* (Gr. ζυγόν, *zugon*, a yoke ; δάκτυλος, *daktulos*, a digit) ; and birds exhibiting it are said to be *yoke-toed* (fig. 45). In all yoke-toed birds, excepting the trogons, it is the *outer* anterior toe which is reversed ; in trogons, the

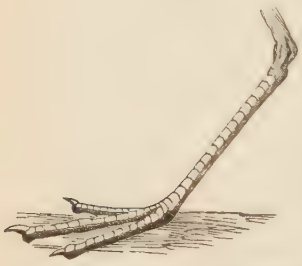


Fig. 39. — Tridactyle foot of sanderling, *Calidris arenaria ;* nat. size.

inner one. In nearly every three-toed bird, all three toes are anterior; our single exception is in the genus *Picoïdes*, where the true hind toe is wanting, the outer anterior one being reversed as usual in zygodactyles. No bird has more toes behind than in front. Birds' toes, and their respective joints, are

Numbered, in a certain definite order, as follows (see figs. 34, 36): hind toe = *first* toe, 1 *t*; inner anterior toe = *second* toe, 2 *t*; middle anterior toe = *third* toe, 3 *t*; outer anterior toe = *fourth* toe, 4 *t*. Such identification of 1 *t*, 2 *t*, 3 *t*, 4 *t* applies to the ordinary case of three toes in front and one behind. But, obviously, it holds good for any other arrangement of the toes, if we only know which one is changed in position, — a thing always easy to learn, as we shall see at once. In birds with the hind toe reversed, leaving all four in front, the same order is evident, though then 1 *t* is the inner anterior, 2 *t* the next, etc.; for it always happens, when a hind toe turns forward, that it turns on the *inner* side of the foot. Similarly, in yoke-toed birds (excepting *Trogonidæ*), it is the *outer* anterior which is turned backward, as above said; then, evidently, inner hind toe = 1 *t*; inner front toe = 2 *t*; outer front toe = 3 *t*; outer hind toe = 4 *t*. In *Trogonidæ*, with *inner* front toe reversed, the correction of the formula is easily made. Moreover, when the number of toes decreases from four to three or two, the digits are almost always reduced in the same order: thus, in three-toed birds, 1 *t* is the missing one; in the two-toed ostrich, 1 *t* and 2 *t* are gone. The only known exceptions to this generalization are afforded by two exotic genera of kingfishers, *Ceyx* and *Alcyone*, in which 2 *t* is defective; and by the anomalous passerine *Cholornis* of China, in which 4 *t* is in like case. The rule is proven by the

Number of Phalanges, or joints, of the digits. The constancy of the joints in birds' toes is remarkable, — it is one of the strongest expressions of the highly monomorphic character of *Aves*. In *all* birds, excepting *Procellariidæ*, 1 *t* when present has *two* joints (not counting, of course, the accessory metatarsal). In *all* birds, 2 *t* when present has *three* joints. In *nearly all* birds, 3 *t* has *four* joints. In *nearly all* birds, 4 *t* has *five* joints. Thus, any digit has one more joint than the number of itself. The exceptions to this regularity consist in the lessening of the number of joints of 1 *t* or 3 *t* by *one*, and of 4 *t* by *one* or *two*. So when the joints do not run 2, 3, 4, 5, for toes 1 to 4, they run either, 1, 3, 4, 5, or 2, 3, 4, 4, or 2, 3, 3, 3. (These statements do not regard the anomalous cases of *Ceyx*, *Alcyone*, and *Cholornis* — see above.) This variability is nearly confined to certain Picarian birds: our examples of it are in certain genera of *Cypselinæ*, fig. 40, where the ratio is 2, 3, 3, 3, of *Caprimulginæ*, fig. 41, where it is 2, 3, 4, 4; and the petrel family, with 1, 3, 4, 5. Such admirable conservatism enables us to tell what toes are missing in any case, or what ones are out of the regular position. Thus, in *Picoïdes*, the hind toe, apparently 1 *t*, is known to be 4 *t*, because it is five-jointed; in a trogon, the inner hind toe is 2 *t*, being three-jointed; in the ostrich, with only two toes, 3 *t* and 4 *t* are seen to be preserved, because they are respectively four- and five-jointed. (See fig. 34, where the digits and their phalanges are numbered.) Besides this interesting numerical ratio, the phalanges have other inter-relations of some consequence in classification, resulting from their comparative lengths. In some families of birds, one or more of the *basal* or proximal phalanges (those next to the foot — opposed to *distal*, or those at the ends of the digits) of the front toes are extremely short, being mere nodules of bone (fig. 40); in other and more frequent cases, they are the longest of all, as in figs. 34, 41. On the whole, they generally decrease in length from proximal to distal extremity, and the last one of any toe is quite small, serving merely

FIG. 40. — Phalanges of Cypseline foot, 2, 3, 3, 3.

FIG. 41. — Phalanges of Caprimulgine foot, 2, 3, 4, 4.

as a core to the claw. The difference in the lengths of the several phalanges, like that of the digits themselves, makes the toes more efficient in grasping, since they thereby clasp more perfectly upon an irregular object. The design and the principle are the same as seen in the human hand, in which model instrument the digits and their joints are all of different lengths.

The Position of the Digits, other than in respect to their *direction*, is important. In *all* birds the front toes are inserted on the metatarsus on the same level, or so nearly in one horizontal plane that the difference is not notable. The same may be said of the hind toes when they are a pair, as in zygodactyle birds. But the *hind toe*, or *hallux*, as it is often called, when present and single, varies remarkably in position with reference to the front toes; and this matter requires special notice, as it is important in classification. The insertion of this digit varies, from the very bottom of the tarsus (*metatarsus*), where it is on a level with the front toes, to some distance up the bone. When the hallux is flush with the bases of the other toes, so that its whole length is on the ground, it is said to be *incumbent*. When just so much raised that its tip only touches the ground, it is called *insistent*. When inserted so high up that it does not reach the ground, it is termed *remote* (*amotus*) or *elevated*. But as the precise position varies insensibly, so that the foregoing distinctions are not readily perceived, it is practically best to recognize only two of these three conditions, saying simply "hind toe elevated," when it is inserted fairly above the rest, and "hind toe not elevated," when its insertion is flush with that of the other toes. In round terms: it is characteristic of all *insessorial* (Lat. *insedo*, I sit upon) or perching birds to have the hind toe DOWN; of all other birds to have it UP (when present). The exceptions to the first of these statements are extremely rare; among North American birds they are chiefly furnished by certain genera of *Caprimulgidæ*, perhaps also of *Cypselidæ*, and of *Cathartidæ*. But among other *Raptores* besides *Cathartidæ*, especially certain owls (*Striges*), and in some of the pigeons (*Columbidæ*), the hind toe is not quite down, or is decidedly uplifted (as in *Starnœnas*, for example). It is elevated in all our rasorial birds (*Gallinæ*); elevated in all our waders excepting the herons and some of their allies (*Herodiones*), though not very markedly so in the rail family (*Rallidæ*). It is elevated in *all* swimming birds, whether lobe-footed or completely or partly web-footed, but in the totipalmate order (*Steganopodes*), where the hallux is lateral in position and webbed with the inner toe, the elevation is slight. Now since, curiously enough, the only ones of our insessorial genera (see above) that have the hind toe up, have also little webs between the front toes — since some *Raptores* are our only other insessorial birds with any such true webbing — since herons and some of their allies are our only birds with such webbing that have the hallux down — the following rule is perhaps infallible for North American birds: *Consider the hind toe* UP *in any bird with any true webbing or lobing of the front toes*, excepting herons and some of their allies and some birds of prey. The converse also holds almost as well: for our only birds with fully cleft anterior toes and hind toe up, are the rails and gallinules (*Rallidæ*), the black-bellied plover (*Squatarola helvetica*), our only four-toed plover, the turn-stone (*Strepsilas interpres*), the American woodcock (*Philohela minor*), the European woodcock (*Scolopax rusticula*), Wilson's snipe (*Gallinago wilsoni*), and most of the sandpipers (*Scolopacidæ*). If the sense of this paragraph is taken in, the student who wishes to use my artificial "key" will seldom be puzzled to know whether to take the toe up or down.

The Hallux has other Notable Characters. — It is *free* and *simple*, in the vast majority of birds: in all *insessorial* birds, nearly all *cursorial* (Lat. *cursor*, a courser), and most *natatorial* (Lat. *natator*, a swimmer) forms. Its length, claw included, may equal or surpass that of the longest anterior toe: and generally exceeds that of one or two of these. It is never so long as when *incumbent*; when thus down on a level with the rest it also acquires its greatest mobility

and functional efficiency. In most *Passeres* it is virtually provided with a special muscle for independent movement, so that it may be perfectly apposable to the other toes collectively, just as our thumb may be brought against the tip of any finger. In general, it shortens as it rises on the metatarsus; and probably in no bird in which it is truly elevated is it as long as the shortest anterior toe. It is short, barely touching the ground, in most wading birds; shorter still in some swimmers, as the gulls, where it is probably functionless; it is incomplete in one genus of gulls (*Rissa*), where it bears no perfect claw; it has only one phalanx and is represented only by a short immovable claw in the petrels (*Procellariidæ*); it disappears in the birds named in the last paragraph but two above, and in some others. It is never actually soldered with any other toe, for any noticeable distance; but it is webbed to the base of the inner toe in the loons (*Colymbus*), and to the whole length of the toe in all the *Steganopodes* (fig. 52). It may also be independently webbed; that is, be provided with a separate flap or lobe of free membrane. This lobation of the hallux is seen in all our sea-ducks and mergansers (*Fuligulinæ* and *Merginæ*), and in all the truly lobe-footed birds, as coots (*Fulica*), grebes (*Podicipedidæ*) and phalaropes (*Phalaropodidæ*). The modes of union of the anterior toes with one another may be finally considered under the head of the

Three leading Modifications of the Avian Foot. — Birds' feet are modelled, on the whole, upon one or another of three plans, furnishing as many *types of structure;* which types, though they run into one another, and each is variously modified, may readily be appreciated. These plans are the perching or *insessorial*, the walking or wading, *cursorial* or *grallatorial*, and the swimming or *natatorial* — in fact, so well distinguished are they, that carinate birds have even been primarily divided into groups corresponding to these three evidences of physiological adaptation of the structure of the Avian *pes*. Independently of the number and position of the digits, the plans are pretty well indicated by the method of union of the toes, or their entire lack of union. 1. *The insessorial type.* (*a*) In order to make a foot the most of *a hand*, that is, to fit it best for that grasping function which the perching of birds upon trees and bushes requires, it is requisite that the digits should be as free and movable as possible, and that the hind one should be perfectly apposable to the others. Compare the human hand, for example, with the foot, and observe the perfection secured by the perfect freedom of the fingers and especially the appositeness of the thumb. In the most accomplished insessorial foot, the front toes are *cleft to the base*, or only coherent to a very slight extent; the hind toe is completely incumbent, and as long and flexible as the rest. Our thrushes (*Turdidæ*) probably show as complete cleavage as is ever seen, practically as much as that of the human fingers; the cleft between the inner and middle toe being to the very base, while the outer is only joined to the middle for about the length of its own basal joint. This is the typical *passerine* foot (figs. 36, 37, 42, 43). There may be somewhat more cohesion of the toes at base, as in the wrens, titmice, creepers, vireos, etc., without, however, obscuring the true passerine character. As regards this matter, the point is, that when the toes are united at all, it is by their actual *cohesion* there, not by movable webbing. Besides the typical passerine, there are several other modifications of the insessorial foot. (*b*) Thus a kingfisher shows what is called a *syndactyle* or *syngnesious* (Gr. *σύν*, *sun*, together; *γνήσιος*, *gnesios*, relating to way of birth) foot (fig. 44), where the outer and middle toes cohere for most of their extent and have a broad sole in common. It is a degradation of the insessorial foot, and not a common

FIGS. 42, 43. — Typical passerine feet. (The right-hand fig. is *Plectrophanes lapponicus*, nat. size.)

one either; seen in those perching birds which scarcely use their feet for progression, but simply for sitting motionless. (*c*) The *zygodactyle* or yoke-toed modification has been sufficiently noted (fig. 45). It was formerly made much of, as a *scansorial* or *climbing* type of foot, and an absurd "order" of birds has been called *Scansores*. But many of the zygodactyle birds do not climb, as the cuckoos; while the most nimble and adroit of climbers, such as the nuthatches and creepers, retain a typically passerine foot. The "scansorial" is simply one modification of the insessorial plan, and has little classificatory significance, — no more than that attaching to the particular condition of the insessorial foot (*d*) which results from elevation or versatility of the hind toe, as in some *Cypselidæ* and *Caprimulgidæ*. This is an abnormality which has received no special name; it is generally associated with some little webbing of the anterior toes at base, which is a departure from the true insessorial plan, or with abnormal reduction of the phalanges of the third and fourth toes, as explained above (figs. 40, 41). (*e*) The *raptorial* is another modification of the insessorial foot. It is advantageous to a bird of prey to be able to spread the toes as widely as possible, that the talons may seize the prey like a set of grappling irons; and accordingly the toes are widely divergent from each other, the outer one in the owls and a few hawks being quite versatile. In a foot of raptorial character, the toes are cleft profoundly, or, if united at base, it is by movable webbing; the claws are immensely developed, and the under-surfaces of the toes are scabrous or bulbous for greater security of the object grasped. Any hawk or owl or old-world vulture exhibits the raptorial insessorial foot (figs. 46, 47). 2. *The cursorial* or *grallatorial type.* The gist of this plan lies in the decrease or entire loss of the grasping function, and in the elevation, reduction in length, or loss of the hind toe; the foot is a good foot, but nothing of a hand. The columbine birds, which are partly terrestrial, partly arboreal,

FIG. 44. — Syndactyle foot of kingfisher, nat. size.

FIG. 45. — Zygodactyle foot of a woodpecker, *Hylotomus pileatus*, nat. size.

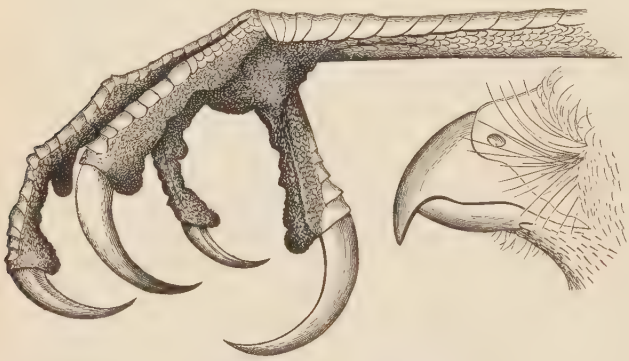


FIG. 46. — Raptorial foot of a hawk, *Accipiter cooperi*, nat. size.

FIG. 47. — Raptorial foot of an owl, *Aluco flammeus*, nat. size.

exhibit the transition from the perching to the gradient foot, in some reduction of the hind toe, which is nevertheless in most cases still on the same level as the rest (fig. 38, *b*). In the gallinaceous or rasorial (Lat. *rasor*, a scraper) birds, which are essentially terrestrial, and noted for their habit of scratching the ground for food, the hind toe is decidedly elevated and shortened in almost all of the families (fig. 35). Such reduction and uplifting of the hallux is carried to an extreme in most of the waders, or *grallatores*, in many of which this toe disappears (figs. 38, *a*, 39). It is scarcely practicable to recognize special modifications of such gradient or grallatorial feet, since they merge insensibly into one another. The herons, which are the most arboricole of the waders, exhibit a reversion to the insessorial type, in the length and incumbency of the hallux. The mode of union of the front toes of the walkers and waders is somewhat characteristic. The toes are either cleft quite to the base, or there joined by small webs; probably never actually coherent. Such basal webbing of the toes is called *semipalmation* ("half-webbing"). It is actually the same thing that occurs in many birds of prey, in most gallinaceous birds, etc.; the term is mostly restricted, in descriptive ornithology, to those *wading* birds, or *grallatores*, in which it occurs. Such basal webs generally run out to the end of the first, or along part of the second, phalanx of the toes; usually farther between the outer and middle than between the middle and inner toes. Such a foot is well illustrated by the semipalmated plover (*Ægialites semipalmatus*), semipalmated sandpiper (*Ereunetes pusillus*, fig. 48), and willet (*Symphemia semipalmata*, fig. 49). In a few wading birds, as the avocet and flamingo, the webs extend to the ends of the toes. This introduces us at once to the *third* main modification of the foot, 3. *The natatorial type.* Here the foot is transformed into a swimming implement, usually with much if not entire abrogation of its function as foot or hand. Swimming birds with few exceptions are notoriously bad walkers, and few of them are perchers. The swimming type is presented under two principal modifications: — (*a.*) In the *palmate* or ordinary webbed foot, all the front toes are united by ample webs (fig. 50). The palmation is usually complete, extending to the ends of the toes; but one or both webs may be so deeply *incised*, that is, cut away, that the palmation is practically reduced to semipalmation, as in terns of the genus *Hydrochelidon* (fig. 51). The *totipalmate* is a special case of palmation, in which all four toes are webbed; this characterizes the whole order *Steganopodes* (fig. 52). (*b.*) In the *lobate* foot, a paddle results not from connecting webs, but from a series of *lobes* or flaps along the sides of the individual toes; as in the coots, grebes, phalaropes, and sun-birds (*Heliornithidæ*). Lobation is usually associated with semipalmation, as is well seen in the grebes (*Podicipedidæ*). In the snipe-like phalaropes (*Phalaropodidæ*), lobation is present as a modification of a foot otherwise quite cursorial. The most emphatic cases of lobation are those in which each joint of the toes has its own flap, with a free convex border; the membranes as a whole therefore present a scolloped outline (figs. 53, 53 *bis*). Such lobes are merely a development of certain *marginal fringes* or processes exhibited by many non-lobate or non-palmate birds. Thus, if the foot of some of the gallinules be examined in a fresh state, the toes will be seen to

FIG. 48. — Semipalmation in *Ereunetes;* nat. size.

FIG. 49. — Semipalmated bases of toes of *Symphemia;* nat. size.

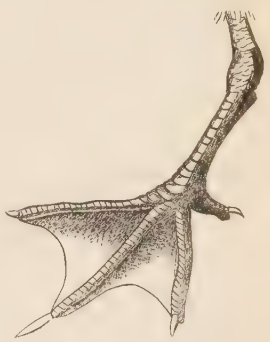


FIG. 50. — Palmate foot of a tern, *Sterna forsteri;* nat. size.

FIG. 51. — Incised palmation of *Hydrochelidon lariformis;* nat. size.

have a narrow membranous margin running the whole length. The same thing is evident in a great many waders, and on the free borders of the inner and outer toes of web-footed birds.

FIG. 52. — Totipalmate foot of a pelican; reduced.

In the grouse family (*Tetraonidæ*), marginal fringes are very conspicuous; there being a great development of hard horny substance, fringed into a series of sharp teeth or *pectinations* (fig. 35). These formations appear to be deciduous, that is, to fall off periodically, like parts of the claws of some quadrupeds (lemmings).

FIG. 53. — Lobate foot of a coot; reduced.

Claws and Spurs. — With rare anomalous exceptions, as in the case of an imperfect hind toe, every digit terminates in a complete *claw*. The general shape is remarkably constant in the class; variations being rather in degree than in kind. A cat's claw is about the usual shape: it is *compressed, arched, acute*. The great talons of a bird of prey are only an enlargement of the typical shape; and, in fact, they are scarcely longer, more curved, or more acute than those of a delicate canary bird; they are simply stouter. The claws of scansorial birds are very acute and much curved, as well as quite large. The under surface of the claw is generally excavated, so that the transverse section, as well as the lengthwise outline below, is concave, and the under surface is bounded on either side by a sharp edge. One of these edges, particularly the inner edge of the middle claw, is expanded or dilated in a great many birds; in some it becomes a perfect *comb*, having a regular series of teeth. This *pectination* (Lat. *pecten*, a comb), as it is called, only occurs on the inner edge of the middle claw. It is beautifully shown by all the true herons (*Ardeidæ*); by the whip-poor-wills and night-hawks (*Caprimulgidæ*, fig. 41); by the frigate pelican (*Tachypetes*); and imperfectly by the barn owl (*Aluco flammeus*). It is supposed to be used for freeing parts of the plumage that cannot be reached by the bill from parasites; but this is very questionable, seeing that some of the shortest-legged birds, which cannot possibly reach much of the plumage with the comb, possess that instrument. Claws are more *obtuse* among the lower birds than in the insessorial and scansorial groups, as the columbine and gallinaceous (*rasorial*) orders, and most natatorial families. Obtuseness is generally associated with flatness or depression; for in proportion as a claw becomes less acute, so does it lose its arcuation, as a rule. This is well illustrated by Wilson's petrel (*Oceanites oceanicus*), as compared with others of the same family. Such condition is carried to an extreme in the grebes (*Podicipedidæ*), the claws of which birds resemble human finger-nails. Otherwise, deviations from curvature, without loss of acuteness, are chiefly exhibited by the *hind* claw of many terrestrial *Passeres*, as in the whole family *Alaudidæ* (larks), and some of the finches (*Fringillidæ*), as the species of "long-spur" (*Centrophanes*). But all the claws are straight, sharp, and prodigiously long, in birds of the genus *Parra* (fig. 53 *ter*); these jaçanás being enabled to run lightly over the floating leaves of aquatic plants by so much increase in the spread of their toes that they do not "slump in." Claws are

FIG. 53 *bis*. — Lobate foot of phalarope, *Lobipes hyperboreus*: nat. size.

also variously *carinate* or ridged, *sulcate* or grooved. In a few cases they are rounded underneath, so as to be nearly circular in cross-section, as is the case with those of the fish-hawk (*Pandion*). They are always horny (*corneous*). They take name from and are reckoned by their respective digits: thus, 1 *cl.* = claw of 1 *t*; 2 *cl.* = claw of 2 *t*, etc.

FIG. 53 *ter.* — Foot of *Parra gymnostoma*, nat. size, showing the long, straight claws. (From Pr. U. S. Nat. Mus. The *spurred* wing of the same bird is also shown. See p. 114.)

Spurs (Lat. *calcar*, a spur) are developed on the metatarsal bones of a few birds. They are of the nature of claws, being hard, horny modifications of the epiderm: but they have nothing to do with the digits. They possess a bony core upon which they are supported, like the horns of cattle. Such growths chiefly occur in gallinaceous birds: the spurs of the domestic fowl are a familiar case. Sometimes there are a pair of such weapons on each foot, as in the *Pavo bicalcaratus*. The only instance of their occurrence among indigenous birds of North America is offered by the wild turkey (*Meleagris gallipavo*). Metatarsal spurs are characteristic of the male sex; they are offensive weapons, and belong to the class of "secondary sexual characters" (p. 90). (For wing-spurs, as shown in fig. 53 *ter*, see p. 114.)

§ 4. — AN INTRODUCTION TO THE ANATOMY OF BIRDS.

Anatomical Structure now affords ornithologists many and the most important of the characters used in classification. In fact, few if any of the groups above genera can be securely established without consideration of internal parts and organs, as well of exterior modifications of structure. Therefore, the student who really "means business" must be on speaking terms at least with avian anatomy. For example, none could in the least intelligently understand a wing or a leg without knowing the bony framework of those members. Yet, for me to adequately set this matter forth would be to occupy this whole volume with anatomy; whereas, I can only devote a few pages to the entire subject. In such embarrassment, which attends any attempt to treat a great theme in a short way that shall not also be a small way, attention must be mainly confined to those points which bear most directly upon systematic ornithology as distinguished from pure anatomy, in order to bring forward the structures which are more particularly concerned in the classification of birds. I wish to give a fair account of the skeleton, as osteological characters are of the utmost importance for the determination of natural affinities; and to continue with some notice of prominent features of the muscular, vascular, respiratory, digestive, urogenital, and nervous systems, and organs of the special senses, as the eye and ear. The tegumentary system has already been treated at some length (pp. 82–91); so has the osseous system, so far as the bones of the limbs are concerned (pp. 106–109, 118–122, 127). What further I shall have to say is designed merely as an introduction to the rudiments of avian anatomy, and is supposed to be addressed to beginners only.

a. Osteology: The Osseous System, or Skeleton.

Osteology (Gr. *ὀστέον*, *osteon*, a bone: *λόγος*, *logos*, a word) is a scientific description of bone in general and of bones in particular. Bone consists of an animal basis or matrix (Lat. *matrix*, a mould) hardened by deposit of earthy salts, chiefly phosphate of lime. Bone is either preformed in the gristly substance called *cartilage* (Lat. *cartilago*, gristle), and results from the substitution of the peculiar osseous tissue for the cartilaginous tissue, or it is formed directly in ordinary connective tissue, such as that of most membranes or any ligaments of the body. Bone tissue presents a peculiar microscopic structure, in which it differs from teeth, as it does also in not being developed from mucous membrane; the substance is called *ostein*, as distinguished from *dentine*. Though very dense and hard, bone has a copious blood-supply, and is therefore very *vascular*; the nutrient fluid penetrates every part in a system of vessels called *Haversian canals*. In the natural state bone is covered with a tough membrane called *periosteum* (Gr. *περί*, *peri*, around, and *ὀστέον*), which is to bone what bark is to a tree. The bones collectively constitute the *osseous system*, otherwise known as the *skeleton* (Gr. *σκελετόν*, dried, as bones usually are when studied). The skeleton is divided into the *endoskeleton* (Gr. *ἔνδον*, *endon*, within), consisting of the bones inside the body; and the *exoskeleton* (Gr. *ἐξ*, *ex*, out of), or those upon the surface of the body, of which birds have none. Certain bones developed apart from the systematic endoskeleton, in fibrous tissue, are called *scleroskeletal* (Gr. *σκληρός*, *scleros*, hard), as the ossified tendons or leaders of a turkey's leg, the ring of ossicles in a bird's eye (an *ossicle* is any small bone). *Sesamoid* (Gr. *σησαμη*, *sesame*, a kind of pea) bones, so often found in the ligaments and tendons about joints, are probably best considered scleroskeletal. The endoskeleton is divided into bones of the *axial skeleton*, so called because they lie in the axis of the body, as those of the skull, backbone, chest, pelvis, and shoulder-girdle: and of the *appendicular skeleton*, including bones of the limbs, considered as diverging appendages of the trunk. The skeleton is jointed; bones join either by immovable *suture*, or by movable *articulation* (Lat. *articulus*, a joint, dimin. of *artus*, a limb). In free articulations, the opposing surfaces are generally smooth, and lubricated with a fluid called *synovia*. Progressive ossification often causes bones originally distinct to *coössify*, that is, to fuse together; this is termed *ankylosis* or *anchylosis*; bones so melted together are said to be *ankylosed* or *anchylosed* (Gr. *ἀγκύλωσις* or *ἀγχύλωσις*, the stiffening of joints in a bent position). Thus all the bones of a bird's brain-box are anchylosed together, though the box at first consists of many distinct ones; and the determination of such osseous elements or integers in compounded bones is a very important matter, as a clue to their morphological composition. The names of most individual bones, chiefly derived from the old anatomists, are arbitrary and have little scientific signification: many are fanciful and misleading; bones named since anatomy passed from the empiric stage, when it was little more than the art of dissecting and describing, however, have as a rule better naming. The shaft of a long bone is its *continuity*: the enlargements usually found at its extremities are called *condyles* (Gr. *κόνδυλος*, *kondulos*, a lump, knot, as of the knuckles). Points where ossification commences in cartilage or membrane, are *ossific centres*, or *osteoses*; valuable clues, usually, to the elements of compound bones. But ossification of individual simple bones may begin in more than one spot, and the several osteoses afterward grow together. This is especially the case with the *ends* of bones, which often make much progress in ossification before they unite with the shaft or main part; such caps of bone, as long as they are disunited, are called *epiphyses* (Gr. *ἐπί*, *epi*, upon; *φύσις*, *phusis*, growth). Protrusive parts of bones have the general name of *processes*, or *apophyses* (Gr. *ἀπό*, *apo*, away from, and *φύσις*); such have generally no ossific centres, being mere outgrowths. But many parts of a vertebra, which are called "apophyses," have independent ossific centres. The progress of ossification is usually rapid and effectual.

The skeleton of birds is noted for the number and extent of its anchyloses, a great tendency to coössification and condensation of bone-tissue resulting from the energy of the vital activities in this hot-blooded, quick-breathing class of creatures. Birds' bones are remarkably hard and compact. When growing, they are solid and marrowy, but in after life more or fewer of them become hollow and are filled with air. This *pneumaticity* (Gr. πνευματικός, *pneumatikos*, windy) is highly characteristic of the avian skeleton. Air penetrates the skull-bones from the nose and ear-passages, and may permeate all of them. It gains access to the bones of the trunk and limbs by means of air-tubes and air-sacs which connect with the air-passages in the lungs; such sacs, sometimes of great extent, are also found in many places in the interior of the body, beneath the skin, etc.; sometimes the whole subcutaneous tissue is pneumatic. The extent to which the skeleton is aërated is very variable. In many birds only the skull, in a few the entire skeleton, is in such condition; ordinarily the greater part of the skull, and the lesser part of the trunk and limbs, is pneumatized. The passage of air in some cases is so free, as into the arm-bone for example, that a bird with the windpipe stopped can breathe

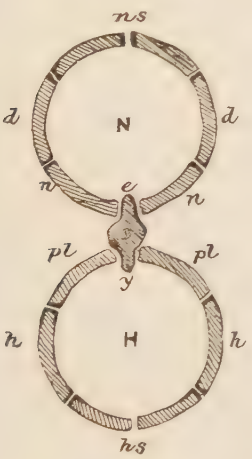


FIG. 54. — Ideal plan of the double-ringed body of a vertebrate. *N*, neural canal; *H*, hæmal canal; the body separating them is the centrum of any vertebra, bearing *e*, an epapophysis, and *y*, a hypapophysis; *n*, *n*, neurapophyses; *d*, *d*, diapophyses; *ns*, bifid neural spine; *pl*, *pl*, pleurapophyses; *h*, *h*, hæmapophyses; *hs*, bifid hæmal spine. Drawn by Dr. R. W. Shufeldt, U. S. A., after Owen.

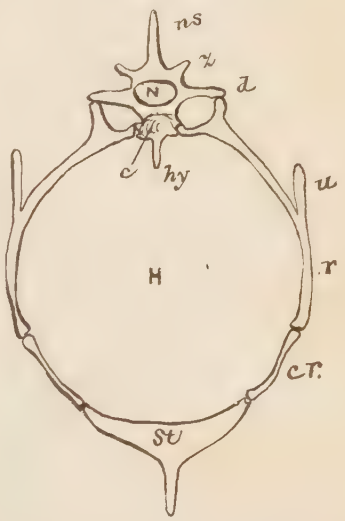


FIG. 55. — Actual section of the body in the thoracic region of a bird. *N*, neural canal; *H*, hæmal canal; *c*, centrum of a dorsal vertebra; *hy*, hypapophysis; *d*, diapophysis; *z*, zygapophysis; *ns*, neural spine; *r*, pleurapophysis, or vertebral part of a free rib, bearing *u*, uncinate process or epipleura; *cr*, hæmapophysis or sternal part of the same; *st*, section of sternum or breast-bone (hæmal spine). Designed by Dr. R. W. Shufeldt, U. S. A.

for an indefinite period through a hole in the humerus. Pneumaticity is not directly nor necessarily related to power of flight; some birds which do not fly at all are more pneumatic than some of the most buoyant. (On the general pneumaticity of the body see beyond under head of the respiratory system.)

The Axial Skeleton (figs. 54, 55, 56) of a bird or any *vertebrated* animal, that is, one having a back-bone, exhibits in cross-section two rings or hoops, one above and the other below a central point, like the upper and lower loops of a figure **8**. The upper ring is the *neural arch* (Gr. νεῦρον, *neuron*, a nerve), so called because such a cylinder encloses a section of the cerebro-spinal axis, or principal nervous system of a vertebrate (brain and spinal cord,

whence arise all the nerves of the body, excepting those of the sympathetic nervous system). The lower ring is the *hæmal arch* (Gr. αἷμα, *haima*, blood), which similarly contains a section of the principal blood-vessels and viscera. Fig. 55 shows such a section, made across the *thoracic* or chest-region of the trunk. Here the upper ring (neural) is contracted, only surrounding the slender spinal cord, while the lower ring is expanded to enclose the heart and

FIG. 56.—Axial skeleton, minus the skull, of an owl, *Asio wilsonianus*, life size; from nature by Dr R. W. Shufeldt, U. S A. *at*, atlas; *ax*, axis; *cv*, cervical vertebræ; *c*, *c'*, cervical ribs, or free pleurapophyses; *dv*, dorsal vertebræ, excepting the last one, which joins the sacrum; *R*, two of the six true ribs (pleurapophyses), whereof *sr* is sacral; *u*, one of the five uncinate processes or epipleura; *cr*, two of the six sternal ribs (hæmapophyses), whereof the sixth floats; *p*, pelvic or sacral region of the spine, comprehending one dorsal, and several lumbar, sacral proper, and urosacral vertebræ; *I*, ilium; *Is*, ischium; *P*, pubis; *a*, acetabulum; *in*, ischio-iliac foramen; *o*, obturator foramen; *clv*, caudal or coccygeal vertebræ, whereof *py* is the pygostyle; *s*, scapula; *ohs*, os humero-scapulare; *cl*, clavicle; *C*, coracoid; *S*, sternum. (For extent of *dv*, see note 2, p. 138.)

lungs. Such a section, made in the region of the skull, would show the reverse; the upper ring greatly inflated to contain the brain, the lower contracted and otherwise greatly modified into bones of the jaws. Thus the trunk of a vertebrate is a double-barrelled tube; one tube above for the nervous system, the other below for the viscera at large; the partition between the two being a jointed chain of solid bones from one end of the body to the other. These solid bones are the *centrums* or *bodies of vertebræ*, in the trunk; and in the head certain

bones which in some respects correspond with the centrums of vertebræ. The entire chain or series of vertebræ composes the back-bone or *spinal column;* with its connections (thorax and pelvis) and anterior continuation (skull) it is the *axial skeleton.* The skull is considered by some competent anatomists to consist of modified vertebræ. The skull-bones have certainly the position and relations of parts of vertebræ; to a certain extent they resemble vertebræ, as in being divisible into several segments, like as many vertebral segments; they are also directly in the axis of the body, enclosing a part of the cerebro-spinal nervous system above, and portions of the visceral systems below. But supposed strict morphological correspondence of cranial bones with vertebræ is not supported by their mode of development, and is now generally denied, the relation being considered rather analogical and physiological than homological and morphological.

1. *THE SPINAL COLUMN.*

A Vertebra (so called from the flexibility of the chain of vertebræ; Lat. *verto,* I turn) consists of a solid body or *centrum,* and more or fewer processes or apophyses, some of which have separate ossific centres. Plate-like processes which arch upward from either side of a centrum to enclose the neural canal are the *neural arches* or *neurapophyses* (fig. 54, *n, n*); at their union in the middle line above they commonly send up a process called the *neural spine* (*ns*). Transverse processes from the sides of the neural arch are *diapophyses* (Gr. διά, *dia,* across) (figs. 54, 55, *d, d*). Oblique processes from the sides of the same arches, serving to lock them together, are *zygapophyses* (Gr. ζυγον, *zugon,* a yoke; fig. 55, *z*); there are two on each side; one anterior, on the front border of an arch, a *pre-zygapophysis;* one posterior, on the hind border, a *post-zygapophysis.* From the under-side of a centrum, in the middle line, there is often a *hypapophysis* (Gr. ὑπό, *hupo,* under; fig. 55, *hy*). These several processes, with some others not necessary to mention here, make with the centrum *a vertebra* in strictness; that is, when existing at all, they are completely consolidated with one another and with the centrum into one bone. But certain important elements of a vertebra, developed from independent ossific centres, may or may not anchylose therewith, in different regions of the same spinal column. These are the *pleurapophyses* (Gr. πλευρόν, *pleuron,* a rib; fig. 54 *pl*; fig. 55, *r*). Any *rib* is in fact the pleurapophysial element of a vertebra; it may be, and in most regions of the spinal column it is, quite small when existing at all, and anchylosed with the vertebra to which it belongs, as an integral portion thereof. Only in the lower region of the neck, and throughout the thoracic region, such pleurapophyses elongate, and are movably articulated with their respective vertebræ; they then become the "ribs" of ordinary language. Moreover, the true thoracic ribs of birds are jointed near the middle, each thus consisting of two pieces; the upper piece is pleurapophysis proper: the lower is called a *hæmapophysis* (fig. 54, *h*; fig. 55, *cr*); it corresponds to a "costal cartilage" of human anatomy. Once again: since the *sternum* (breast-bone) is theoretically, and doubtless archetypically, a solidified set of those parts of the vertebral segments which complete the hæmal arches below, each segment of a sternum to which a hæmapophysis is articulated is called a *hæmal spine,* being compared to a neural spine above. Aside from any consideration of the ribs proper and sternum, or free pleurapophyses, hæmapophyses, and hæmal spines, any "vertebra" of ordinary language is the compound bone which consists of centrum and neur-, di-, pre- and post-zyg-, pleur-, hyp- and other -apophyses, if any, and neural spine; the latter being often called the "spinous process."

The Vertebræ join one another, forming a continuous chain. Their centra are placed end to end, one after another; their neural arches are also locked together by the zygapophyses, when such articular processes are developed. Zygapophyses bear upon their free ends smooth articular facets, the faces of which are mostly horizontal; those of the pre-zygapophyses looking downward, and overriding the reversed faces of the post-zygapophyses. The mode of jointing

of the centra of such vertebræ as are freely movable upon each other is highly characteristic of birds, in so far as the *shapes* of the articular ends of the vertebral centra are concerned. In anatomy at large, a vertebral centrum which is cupped or hollowed at both ends, is of course bi-concave. Such a vertebra is called *amphicœlous* (Gr. *ἀμφί, amphi*, on both sides; *κοῖλος, koilos*, hollowed); this is the rule in fishes, and obtained in some extinct Cretaceous birds, as *Ichthyornis;* it is unknown in recent birds.[1] A centrum cupped in front only is *procœlous;* one cupped only behind is *opisthocœlous* (Gr. *ὄπισθε, opisthe*, behind). Such structure necessarily results in a ball-and-socket jointing of vertebræ. In those vertebræ of birds in which this arrangement obtains, it is always the *posterior* face of a centrum which is cupped, the anterior one being balled; such vertebræ are therefore opisthocœlous. But in the freest vertebral articulation of birds, that existing in the region of the neck, another modification occurs. Both ends of each vertebra are *saddle-shaped; i. e.*, concave in one direction, convex in the other; a condition which may be called *heterocœlous* (Gr. *ἕτερος, heteros*, contrary). The concavo-convexity of any one vertebra fits the reciprocal concavo-convexity of the next. *Anterior* faces of heterocœlous vertebræ are concave crosswise, up-and-down convex; *posterior* faces are the reverse; consequently, such vertebræ are procœlous in horizontal section, but in vertical section opisthocœlous. The various physical characters of vertebræ in different regions of the body, and their connections with and relations to other parts of the body, have caused their division into several sets, as cervical, dorsal, etc., which are best considered separately.

Cervical Vertebræ (fig. 56, *cv*) are those of the *neck:* all those in front of the thorax or chest, which do not bear free pleurapophyses in adult life, or the free pleurapophyses of which, if any, are not in two-jointed pieces and do not reach the breast-bone; *i. e.*, have no hæmapophyses. It is advisable, in birds, to draw this line between cervical and succeeding vertebræ, no other being equally practicable; for, on the one hand, one, two or more of the cervicals (recognizable as such by their general conformation and free articulation) may have long free ribs, movably articulated; and all the cervicals, excepting usually the first, or first and second, have short pleurapophyses, anchylosed in adult life, but free in the embryo; while, on the other hand, a vertebra, apparently dorsal by its configuration and even its anchylosis with the dorsal series, may be entirely cervical in its pleurapophysial character.[2] Thus, in fig. 56, of an owl's trunk, the bone which is apparently first dorsal, and is so marked (*dv*), bears a free styliform "riblet" an inch long (*c′*), only it is not jointed, and does not reach the sternum; while the next to the last cervical has a minute but still free rib (*c*). In a raven's neck before me, the last cervical rib is about two inches long, articulating by well-defined head and shoulder to body and lateral process of the vertebra; the penultimate rib is about half an inch long, with one articulation to the lateral process; while the next anterior vertebra (third from the last) has a minute ossicle, as a free "riblet." The rule is *two* such free pleurapophyses or cervical ribs of any considerable length: sometimes one; rarely three; in the cassowary four. Rudimentary pleurapophyses may usually be traced up to the second cervical vertebra, as slender

[1] Except to this statement, however, the oddly-massed pygostyle, which, in birds where a terminal disc develops inferiorly, may be distinctly cupped at both ends, as it is in a raven for example.

[2] The case is very puzzling; the more so because, viewing the whole series of birds, the ambiguous "cervico-dorsal," or two such equivocal vertebræ, may lean in different cases in opposite directions when the whole sum of characters is taken into account. Therefore it may be best, as already said, to make the possession of a jointed sternum-reaching rib the criterion of the *first* dorsal vertebra, even though an antecedent one may have the physical characters of a dorsal, and be anchylosed with the dorsal series. This is the view taken by Huxley, who says: "The first dorsal vertebra is defined as such by the union of its ribs with the sternum by means of a sternal rib." (Anat. Vert. Anim., 1872, p. 237.) Owen appears to regard as dorsal any of the vertebræ in question which bear free ribs. The actual uncertainty in the case, and the discrepant reckoning by different authors, prevents us from making a satisfactory count of the numbers of the two series of vertebræ in any given case. Thus, fig 56, as marked by Dr. Shufeldt, shows *six* dorsals (*dv*), to which is to be added the one under *p*, bearing the rib *sr;* and from which is to be subtracted the anterior one, bearing the rib *c′*, which is to be regarded as cervical, though its physical characters are evidently those of the dorsal series.

stylets or riblets, completely anchylosed with the neural arches in adult life, and lying parallel with the long axes of the bones. The anchylosis of pleuropophyses distinguishes most cervical vertebræ in another way: for from it results, on each side of the neural arch, a *foramen* (Lat. *foramen*, a hole, pl. *foramina*), through which blood-vessels (vertebral artery and vein) pass to and from the skull. The series of these foramina is called the *vertebrarterial canal;* none such exist in those posterior cervical vertebræ which bear free ribs; thus, in the raven the canal begins abruptly at the *fourth* from the last cervical. But, as in *Rhea* for instance (and doubtless in many other cases), the vertebrarterial canal shades visibly into the series of foramina formed by the spaces between the head and shoulder of any rib and the side of the vertebra to which it is attached; such being, as I suppose, the true morphology of the canal. The cervical is the most *flexible* region of a bird's spine; the articular ends of the vertebral bodies are the most completely saddle-shaped (heterocœlous); the zygapophyses are large and flaring, overriding each other extensively; the largest processes are at the fore ends of the bones; the appositions of the central and zygapophysial articular surfaces are collectively such, that the column tends to bend in an S-shape or sigmoid curve. The vertebral bodies are more or less contracted in the middle, or somewhat hour-glass-shaped; on several lower cervicals, hypapophyses are likely to be well developed; as are neural spines toward both the beginning and end of the series. The vertebræ on the whole are large; their neural canal is also of ample calibre. The first two cervicals are so peculiarly modified for the articulation of the skull as to have received special names. The *first* one, fig. 56, *at*, the *atlas* (so called because it bears up the head, as the giant Atlas was fabled to support the firmament), is a simple ring, apparently without a centrum. The lower part of the ring is deeply cupped to receive the condyle of the occiput into ball-and-socket joint. The *second* cervical is the *axis*, *ax*, which subserves rotary movements of the skull. It has a peculiar tooth-like *odontoid* (Gr. ὀδούς, ὀδόντος, *odous*, *odontos*, tooth; εἶδος, *eidos*, form) process, borne upon the anterior end of its body, fitting into the lower part of the atlantal ring; about which pivot the atlas, bearing the head, revolves like a wheel upon an eccentric axis. The cervicals of birds vary greatly in number; according to Huxley there are never fewer than eight, and there may be as many as twenty-three; Stejneger gives twenty-four for some of the swans. Twelve to fourteen may be about an average number.

Thoracic or Dorsal Vertebræ (fig. 56, *dv*) extend from the cervical to or into the pelvic region of the spine. In most animals, and in ordinary anatomical language, a "dorsal" is one which bears a distinct free rib, and is therefore truly thoracic, since "ribs" are the side-walls of the chest. But in birds, as we have seen, certain cervicals have distinct elongate ribs; and, as will be seen soon, long jointed pleurapophyses are usually found in that region commonly called "sacral." The first dorsal, in birds, is arbitrarily considered to be that one which bears the first rib which is jointed, and which reaches the sternum by its lower (hæmapophysial) half. Five or six vertebræ of birds commonly answer this description; though the last one which bears a long free jointed rib (which may or may not reach the sternum) is commonly anchylosed with the sacrum, as *sr*. So few as only *three* hæmapophysis-bearing ribs may reach the sternum. There may also be a long free-jointed rib which "floats" at *both* ends; *i. e.*, is articulated neither with the sternum nor with the vertebra to which it belongs as in the loon, for example. As the dorsal series thus shades insensibly behind into another series, the lumbar (which has no free, nor any *distinct* ribs, — ribs that one would not hesitate to call such), it is best to consider as dorsal or thoracic all those vertebræ, succeeding the last cervical (which is to be determined as explained in the last paragraph), which have *distinct jointed ribs*, whatever the connection or disconnection of such pleurapophyses at either end. On this understanding, one, sometimes two or even three "dorsal" vertebræ anchylose with the pelvic region of the spine. Fixity of the dorsal region being of advantage to flight, these vertebræ are very tightly locked together; not only by the close apposition or even

anchylosis of their bodies and processes, but also, in many cases, by ossifications of the tendons of muscles of the back, and coössifications of these with the vertebræ, like a set of splints, till the consolidation of the thoracic is only surpassed by that of the pelvic region of the spine. Dorsal vertebræ also usually differ a good deal from most cervicals in having shorter bodies, laterally compressed, producing a ridge which runs along their middle line below; in lacking a vertebrarterial canal; in having on each side two articular facets, — one on the body and the other on the transverse process, for the head and shoulder of a rib. They are further distinguished, usually, by having large spinous processes, in the form of high, long, thin, squarish plates, often or usually anchylosed together. Their transverse processes are also very prominent laterally, thin and horizontal, and often anchylosed. More or fewer dorsals may bear large hypapophyses; which, as in the loon, may bifurcate at their ends into two flaring plates. Such processes continue a similar series from the neck, and are in relation to the advantageous action of the muscles (*rectus colli anticus* and *longus colli*) by which the neck is made to straighten out from the lower curve of its sigmoid flexure.

The "Sacrum" of a Bird (figs. 57, and 60) is commonly considered to be that large solid mass of numerous anchylosed vertebræ in the region of the pelvis, covered in by, and fused more or less completely with, the principal bones of the pelvis, or haunch-bones (*ilia*). But in this consolidation of an extremely variable number (averaging perhaps twelve, but running up to at least twenty, eleven to thirteen being usual) of bones are included vertebræ which in other animals belong to several different sets — dorsal, lumbar, sacral proper, and coccygeal or caudal. We have just seen that one or two, even three, vertebræ, which are dorsal according to the definition agreed upon, may enter into the composition of the "sacrum," being firmly anchylosed therewith, and their long ribs issuing out from underneath the ilia, as shown in fig. 56, *sr*. Next comes one bone, or a series of several (two to five or more) bones, anchylosed together by their bodies and spinous processes, and also anchylosed with the ilia by means of stout lateral bars of bone sent transversely outward on either side from their respective centra to abut against the ilia. These cross-bars correspond in general form and position with the transverse process of the last true rib-bearing dorsal, — that process against which the shoulder of any developed rib abuts; they are variously considered to be, to represent, or to include rudimentary ribs; and such difference of view may be warranted by the state of the parts in different birds. However this may be, the bones just described are *lumbar* vertebræ (Lat. *lumbus*, the loin; where such vertebræ are situated in man and other mammals); which certainly possess abortive ribs in some cases. On successive lumbars the cross-bars, whatever their nature, commonly slip lower and lower downward (belly-ward) on the vertebral bodies, till the last ones are quite down to the level of the ventral aspect of the centrum; these are also commonly the stoutest, most directly transverse, and most nearly horizontal of the series of processes, abutting against the ilia a little in advance of the socket of the thigh bone. This ends a series of consolidated "sacral" vertebræ which are termed collectively "dorso-lumbar,"

Fig. 57. — The "sacrum" of a young fowl, seen from below, nat. size; after Parker. *dl*, dorsolumbar series, whereof the first is dorsal proper, the next three are lumbar; *s*, the sacral series proper, or true sacrum, consisting of five vertebræ; *c*, the urosacral series, being those caudal vertebræ, six in number, which anchylose with one another and with the sacrum.

— all of them anterior to the true *sacrum* of a bird. The *sacrum proper* (fig. 57, *s*) consists of those few vertebræ — three, four, or five — from foramina between which issue the spinal nerves that form the net-work called the *sacral plexus*. These true sacral vertebræ are ribless, and may be recognized, in a general way, by the absence of anything like the cross-bars above described, issuing from the vertebral centra; though their neural arches send off some small bars or plates to fuse with the ilia. These sacrals proper are at or near the middle of the whole sacral mass. After these come a large number — from five to ten or more — of vertebræ which, from their following the true sacrals, though consolidated therewith and with one another, are considered to belong to what would be the caudal region of other animals, and are hence called "tail-sacrals," *uro-sacrals* (Gr. *οὖρα*, tail, fig. 57, *c*.) These continue to send off a series of little plate-like processes from their neural arches, just as the true sacrals do; but, in addition to these, processes are given off from the bodies of the uro-sacrals, corresponding in position and relation to those which proceed from the bodies of the lumbars, and being apparently of the same morphological character (pleurapophysial). These "riblets" are, however, quite slender, and also oblique in two directions; for instead of being transverse and nearly horizontal, they trend very obliquely backward and upward; they also shorten consecutively from before backward. The cross-bars of the latter uro-sacrals, however, are stouter and altogether more like those of a lumbar vertebra. The appearances described are those seen from below, or on the ventral aspect. Above, on the back of the pelvis, the line of confluent spinous processes of the dorso-lumbars is commonly distinct, separated a little from the flaring lips of the ilia. Such distinct formation may continue throughout the sacral and uro-sacral regions; oftener, however, the line of spinous process sinks, flattens, and widens into a horizontal plate which becomes perfectly confluent with the ilia along the posterior portion of their extent; such smooth, somewhat lozenge-shaped surface being quite continuous with the superficies of the pelvis, but perforated with more or fewer pairs of intervertebral foramina. — Such is the general character of a bird's complex sacrum; the description is taken chiefly from a raven (*Corvus corax*); the figure from the common fowl, after Parker. The kidneys are moulded into the recesses between the sacral and uro-sacral vertebræ and in the concavity of the ilia. The general shape of a "sacrum," viewed from below, is fusiform, broadest across the sacral bodies proper or just in front of them, tapering toward either end; the face of the sacrum is also flattest about the middle, more or less ridged before and behind from compression of the vertebral bodies. It has little if any lengthwise curvature, and that chiefly in the uro-sacral region, where the concavity is downward. The total number of bones may be less than twelve, or more than twenty. The extensive anchyloses in this region of the spine are in evident adaptation to bipedal locomotion, which requires fixity hereabouts, that the trunk may not bend upon the fulcrum represented by a line drawn through the hip-joints, which are situated about opposite the middle of the sacral mass, as shown by the arrow, *ac*, in fig. 60. (The word "sacrum," a "sacred thing," curious in this application, is very ancient in human anatomy, commemorating some superstitious or ritualistic notion, respecting this part of the body.)

The Coccygeal, or Caudal Vertebræ (fig. 56, *clv*) proper, terminate the spinal column. They are called "coccygeal," from the fancied resemblance of the human tail-bones collectively to the beak of a cuckoo (Gr. *κόκκυξ*, *kokkux*). The caudals are all the *free* bones situated behind the anchylosed uro-sacrals. The series commonly begins opposite the point where the pelvic bones end; it consists of a variable number of bones, from the twenty long slender ones which the *Archæopteryx* possessed, down to seven or fewer separate ones. The usual number is eight without the pygostyle. They are stunted, degraded vertebræ, whose chief office is to support the tail-feathers: for the leash of nerves which emerge from the spinal canal to form the sacral plexus by so much diminish the spinal cord that a mere thread is left to pene-

trate the tail, though the neural arches of all the coccygeals be still pervious. All may be freely movable, as in the American Ostrich (*Rhea*); but in almost all birds only the anterior ones are distinct and vertebra-like, the rest, to a variable number, being abortive, and melted into that extraordinary affair called the "ploughshare" or *pygostyle* (Gr. πυγή, *puge*, the rump; στῦλος, a post), which may consist of no fewer than ten such metamorphosed tail-bones. It has usually a shape suggesting the share of a plough (see fig. 56, *py*), but is too variable to be concisely described. The pygostyle supports the tail-feathers; and as these are morphologically one pair to each rectrix-bearing vertebra, the number of tail-feathers may be primarily equal to the number of vertebræ which fuse in the pygostyle. Thus the swan is said to have ten vertebræ in this mass; our wild swan (*Cygnus columbianus*) has twenty tail-feathers. In this view, six should be the usual composition of the share-bone. A bird's tail is really more extensive and lizard-like than commonly supposed; thus the swan, besides its ten in the pygostyle, has seven free caudals, and ten uro-sacrals — twenty-seven post-sacral vertebræ in all (Huxley). In the raven, the free caudals are six, exclusive of the pygostyle. These all have large flaring transverse processes and moderate spinous processes, and the latter ones are also provided with hypapophyses, some of which are bifurcate. The pygostyle in many birds expands below into a large circular or polygonal disc.

2. THE THORAX: RIBS AND STERNUM.

The Thorax (Gr. θώραξ, a coat of mail; in anat., the chest; adj. *thoracic;* see fig. 56) is the bony box formed by the ribs on each side, the breast-bone below, and the back-bone above. In birds, it is very extensive, including most or all of the abdominal as well as the thoracic viscera, and its cavity is not partitioned off from that of the belly by a completed *diaphragm*, though a rudimentary structure of that kind is found in the class. The thorax is usually soldered behind to the pelvis by union of one or more pairs of ribs with the ilia; in front it always and entirely bears the *pectoral arch* (see p. 145). The thorax is very movable in birds, by reason of the great length and jointedness of the ribs.

The Ribs (Lat. *costa*, a rib; pl. *costæ;* adj. *costal;* see fig. 56, *c*, *c′*, *R*, *cr*, *sr*, *u*), as said above, are the pleurapophysial elements of vertebræ, which remain small and anchylosed, or become long and free. In the latter state only are they "ribs" in ordinary language. The one or more cervical ribs, however elongated, and the abortive lumbar and uro-sacral ribs, are to be excluded from the present description, and have been already considered. *True ribs* are those which belong to the dorsal vertebræ proper, and are jointed in themselves; that is, have articulated *hæmapophyses* (see p. 137), by which they may or do articulate with the sternum. Such true ribs are *fixed*, when they reach from back-bone to breast-bone; *floating*, when either or neither of these connections is made. Usually the last rib, though bearing a perfect hæmapophysis, does not reach the sternum; in the loon, for example, the last rib floats at *both* ends, having connection neither with vertebra nor sternum; and the two next ribs float at their sternal ends. The perfected ribs are few, — five or six is a usual number, though nine are hæmapophysis-bearing in the loon. The last rib at least is usually "sacral;" *i. e.*, belongs to a dorsal vertebra which is anchylosed with the "sacral" mass; and two or even, as in the loon, three ribs may likewise issue out from under cover of the ilia. These "sacral ribs" are furthermore distinguished by being devoid of the *epipleural* or *uncinate processes* (Lat. *uncus*, a hook; fig. 56, *u*) with which other true ribs are furnished, forming a series of splint-bones proceeding obliquely from one rib to shingle over the next succeeding one, and thus increase the stability of the thoracic side-walls. Such splints may be either articulated or anchylosed with their respective ribs; they have independent ossific centres. The upper (pleurapophysial) part of a rib, or "vertebral rib," when perfected, articulates with the side of the

body of a vertebra by its head or *capitulum* (Lat. dimin. of *caput*, head), and also with the lateral process of the same vertebra by its shoulder or *tuberculum* (Lat. dimin. of *tuber*, a swelling). In well-marked cases, the head and shoulder are quite far apart, the rib seeming prolonged above; either of these vertebral connections may be disestablished, the other remaining, or both may be lost. The lower (hæmapophysial) part of a rib, or "sternal rib," articulates with the side of the sternum by a simple enlargement; the ends of those sternal ribs which thus join the sternum tend to cluster closely together at a part of the breast-bone called its *costal process* (fig. 58); those which do not make the sternal connection are simply bundled together. Commonly five or six, sometimes four, rarely only three ribs reach the sternum. The ribs are ordinarily as slender and strict as those shown in fig. 56; but in *Apteryx*, for example, their pleurapophysial parts are expansive and plate-like. They lengthen rapidly from before backward, both in their vertebral and their sternal moieties; these parts meet at angles of decreasing acuteness from before backward; but these angles, as those of the ribs both with vertebræ and sternum, incessantly increase and diminish in the respiratory movements of the chest; all being in expiration more acute, and more obtuse in inspiration.

The Avian Sternum (Gr. *στέρνον*, *sternon*, the breast; fig. 56, *S*) is highly specialized; its extensive development is peculiar to the class of Birds, and its modifications are of more importance in classification than those of any other single bone. Thereupon it becomes an interesting object. Theoretically it is a collection of hæmal spines of vertebræ. Though such morphological character is appreciable in those animals which have a long jointed sternum, the segments of which, answering to pairs of ribs, develop from separate centres, there is little or nothing in the development or physical characters of the avian sternum to favor this view. The great bone floors the chest and more or less of the belly, and furnishes the main *point d'appui* of both the bony and muscular apparatus of flight, receiving important bones of the scapular arch and giving origin to the immense pectoral muscles. (See also fig. 58.)

Birds offer *two* leading types of sternal structure, the *ratite* and the *carinate*, or the "raft-like" and the "boat-like", according as the bone is flat or keeled (Lat. *ratis*, a raft; adj. *ratite*; in an arbitrary nom. pl., *Ratitæ*, a name of one of the leading divisions of birds: Lat. *carina*, a keel; adj. *carinate*: nom. pl. *Carinatæ*, name of another such division). 1. In all struthious birds, comprehending the ostrich and its allies (and also in the Cretaceous *Hesperornis*), the sternum is a flattish, or rather concavo-convex, buckler-like bone, of somewhat squarish or rhomboidal shape, developed from a single pair of lateral centres of ossification, — a "flat boat," without any keel, built with reference to an important modification of the shoulder-girdle, and a reduced or rudimentary condition of the wings, which are unfit for flight. 2. In all flying birds, and some which from other than any fault of the sternum do not fly, — comprising all remaining recent birds, or *Carinatæ*, and also the Cretaceous *Ichthyornis*, — the sternum is keeled and develops from a median centre of ossification as well as from lateral paired centres; usually two of these, making five in all. In a few *Carinatæ* the keel is rudimentary, as the flightless ground parrot of New Zealand, *Stringops habroptilus*; or otherwise anomalous, as in the extraordinary *Opisthocomus cristatus*, where it is cut away in front, and in the rail-like *Notornis*, where the sternum is extremely like a lizard's. In general, the development of the *keel* is an index of wing-power, whether for flying or swimming, or both; the effectiveness of the pectoral muscles being rather in proportion to depth of keel than to extent of the sides of the "boat-bone;" thus, the keel is enormous in swifts (*Cypselidæ*) and humming-birds (*Trochilidæ*).

The carinate sternum normally develops from five centres, having consequently as many separate pieces in early life. Two of these are lateral and in pairs; the third is median and single. The median ossification, which includes the keel, is the *lophosteon* (Gr. *λόφος*, *lophos*, a crest; *ὀστέον*, *osteon*, a bone). The anterior lateral piece, that with which the ribs, or some

of them, articulate, is the *pleurosteon* (Gr. *πλευρόν*, *pleuron*, a rib); in adult life this becomes the *costal process*, so prominent in *Passeres* (fig. 58). The posterior lateral piece is the *metosteon* (Gr. *μετά*, *meta*, after). From the latter are derived the pair, or two pairs, of lateral processes which the posterior border of the sternum has in so many birds. In fine, the extent of ossification of the lophosteon and metostea, and the mode of their coösification, determines all those various shapes of the posterior border of the sternum which, being commonly characteristic of genera and higher groups, are described for purposes of classification. Thus, if the lophosteon and the metostea are completely ossified and to the same extent behind, the posterior border of the sternum will be transverse, and perfectly bony. Such a sternum is said to be *entire*. If the lophosteon is longer than the lateral pieces, the sternum will have a central pointed or rounded projection; when such a formation is called the middle *xiphoid* process (Gr. *ξίφος*, *xiphos*, a sword: *εἶδος*, *eidos*, form). The projection of the metostea, not infrequent, similarly gives a pair of external lateral xiphoid processes. But such processes oftener result merely from defects of coösification between the elements of the sternum. Thus, there is often a deep notch in the posterior border of the sternum between the lophosteon and the metosteon of each side; the sternum is then said to be *single-notched* or *single-emarginate* (one pair of notches, one on each side; fig. 58). This conformation prevails throughout the great group *Passeres*, possibly without exception; it is therefore highly characteristic of that order, though a great many other birds also have it. In the natural state, the notch is filled in with membrane. Such a notch may also be converted into a "fontanelle" or *fenestra* (Lat. *fenestra*, a window), which is simply a hole in the bone, the metostea having grown to the lophosteon at their extremities, but left an opening between. Such a sternum is called *fenestrate*, more exactly *uni-fenestrate* (Lat. *unus*, one; one window on each side). Now, the parts remaining as before, let either each half of the lophosteon, or each metosteon, be notched or fenestrate; obviously then, such a sternum is *double-notched* or *bi-fenestrate*, having four notches, or holes, two on each side, — two notches, or two holes; or notched *and* fenestrate, having a notch and a hole on each side. The latter is very frequent: when occurring, the hole is generally nearest the middle line, the notch exterior. Irregularity of ossification, converting a hole into a notch, and conversely, may in any case result in lack of symmetry; but this is a mere individual peculiarity. When there are two notches on each side, as in fig. 56, the sternum has evidently a median and two lateral backward extensions, which are then called respectively the *middle*, *internal lateral*, and *external lateral* xiphoid processes. Notching of the lophosteon in the middle line, at least to any extent, must be very rare, if indeed it ever occurs. The extreme case of emargination of the sternum is afforded by the *Gallinæ*, and is highly characteristic of that group. Here the lophosteon is extremely narrow, and fissured deeply away from the metostea, which latter are deeply forked; the arrangement giving rise to two very long slender lateral processes on each side (figs. 1 and 2, p. 48). The sternum of the tinamou, a dromæognathous bird, is still more deeply emarginated, but the extremely long and slender lateral processes, which enclose an oval contour, are simple, not forked.

In a very few birds there are centres of ossification additional to those above described. In *Turnix*, there are said by Parker to be a pair of centres between the pleurostea, which he names *coracostea*, because related to the part of the sternum with which the coracoids (see p. 146) unite. The same authority describes for *Dicholophus* a posterior median cartilaginous flap having a separate centre, named *urosteon* (Gr. *οὖρα*, *oura*, tail). In various birds the sternum is eked out in the middle line behind by cartilage which has no ossification.

The sternum, especially of the higher birds, develops in the middle line in front a beak-like process called the rostrum or *manubrium* (Lat. *manubrium*, a handle); its size and shape vary; it is well-marked in Passerine birds (fig. 58); and may be bifurcate at the end and run down the front of the keel some way, as in the raven. The fore border of the sternum is generally greatly convex from side to side, and then, in those birds which have prominent

pleurostea, produced in angular costal processes. This border is also thickened, and presents on each side a well-marked, smooth-faced groove, in which the expanded feet of the coracoid bones are instepped and firmly articulated. These deep grooves commonly meet in the middle; are occasionally continuous from one side to the other; sometimes each crosses to the other side a little way. The costal processes on each side also have thickened edges, with a series of articular facets for the ribs, which gives this border a fluted or serrate profile. Generally the fore half, or rather less, of the side border of the sternum is thus articular; and it is only such *costiferous* (rib-bearing) extent of sternum which corresponds to the whole body of the bone in a mammal, all the rest being "xiphoid." The singular carinate sternum of *Notornis*, and the ratite bone of *Apteryx*, are concave crosswise along the front border, and bear the coracoids far apart, at the summits of antero-lateral projections.

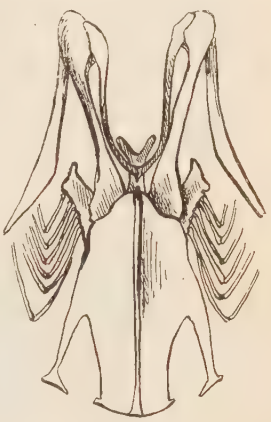


FIG. 58. — Typical passerine sternum, pectoral arches, and sternal ends of ribs; from the robin, *Turdus migratorius*, nat. size; Dr. R.W. Shufeldt, U.S.A. Sternum single-notched, with prominent costal processes and forked manubrium; five ribs reaching sternum, one rib "floating."

A sternum is generally concavo-convex in each direction, bellying downward; somewhat rectangular, it may be long and narrow, or short, broad, and squarish. It is commonly longer than broad, with convex front border, a median beak, which is often forked, prominent antero-lateral corners, pinched-in sides (bulging in tinamou) and indeterminate hind border. The keel usually drops down lowest in front, sloping or curving gently up to the general level behind, with a concave (rarely protuberant) vertical border, and pronounced apex, to which the clavicles may or may not be anchylosed, as they are in a pelican for instance. In *Opisthocomus*, the clavicles anchylose with the manubrium of the sternum. The external surface, both of body and keel, is ridged in places, indicating lines of attachment of the different pectoral muscles. In a few birds, notably swans and cranes, the keel is expanded and hollowed out to receive folds of the windpipe in its interior (see figs. 99, 100). — But the numberless modifications of the sternum in details of configuration belong to systematic ornithology, not to rudimentary anatomy.

3. *THE PECTORAL ARCH.*

The Pectoral Arch (Lat. *pectus*, the breast; figs. 1, 2, 56, 58, 59) is that bony structure by which the wings are borne upon the axial skeleton. It is to the fore limb what the pelvic arch is to the hind limb; but is disconnected from the back-bone and united with the breast-bone, whereas the reverse arrangement obtains in the pelvic, which is fused with the sacral region of the spine. Each pectoral arch of birds consists (chiefly) of three bones: the *scapula* and *coracoid*, forming the *shoulder-girdle* proper, or *scapular arch;* and the accessory *clavicles*, or right and left half of the *clavicular arch*. There is also at the shoulder-joint of most birds an insignificant sesamoid ossicle, called *scapula accessoria* or *os humero-scapulare* (fig. 56, *ohs*); and in many a rudiment of a bone called *procoracoid*, which occurs in reptiles, but in birds is united with the clavicle. From the ribs, the scapula; from the sternum, the coracoid; from its fellow, the clavicle, converges to meet each of the two other bones at the point of the shoulder. The lengthwise scapular arches of opposite sides are distinct from each other; the clavicular arch is crosswise, and nearly always completed on the middle line of the body; by which union of the clavicles the whole pectoral arch is coaptated. The coracoid bears the shoulder firmly away from the breast; the scapula steadies the shoulder against the ribs; the clavicles keep the shoulders apart from each other. The scapular arch is always present and complete; the clavicular is sometimes defective or wanting. There are two leading styles of

scapular arch, corresponding to the ratite and carinate sternum. (1) In *Ratitæ* the axes of the coracoid and scapula are nearly coincident (for the most part in a continuous right line) and anchylosed together; the clavicles are usually wanting, or defective; and the coracoids are instepped on the sternum far apart. (2) In all *Carinatæ*, the axes of the coracoid and scapula form an acute or scarcely obtuse angle (fig. 56, *sglc*); normally these bones are not anchylosed; perfect clavicles are present, anchylosed with each other, but free from the other bones; and the coracoids are instepped close together. Decided exceptions to these conditions, as in *Notornis*, are anomalous; though incompletion of the clavicles repeatedly occurs, as noted below.

The Coracoid (Gr. κόραξ, *korax*, a crow; εἶδος, *eidos*, form: the corresponding bone of the human subject, which is the stunted "coracoid process of the scapula," being likened to a crow's beak; no applicability in the present case; figs. 56, *c*, 59, *c*) is a stout, straight, cylindric bone, expanded at each end, extending forward, outward, and upward from the fore border of the sternum to the shoulder. Its foot is flattened and splayed to fit in the articular groove of fore border of the sternum already described; it often overlaps that of its fellow on the median line; is narrower and remote from its fellow in *Ratitæ*. The head of the bone, irregularly expanded, articulates or anchyloses with the end of the scapula, and also usually with the clavicle. It bears externally a smooth demi-facet, which represents the share it takes in forming the *glenoid* (Gr. γλήνη, *glene*, a shallow pit: fig. 59, *gl*) *cavity*, which is the socket of the humerus. This articular expansion is the *glenoid process* of the coracoid: the *clavicular process* is that by which the bone unites with the clavicle. The relation between the heads of the three bones (each uniting with the other two) is such that a pulley-hole is formed, through which plays the tendon of the pectoral muscle which elevates the wing. The coracoid is a very constant and characteristic bone of birds.

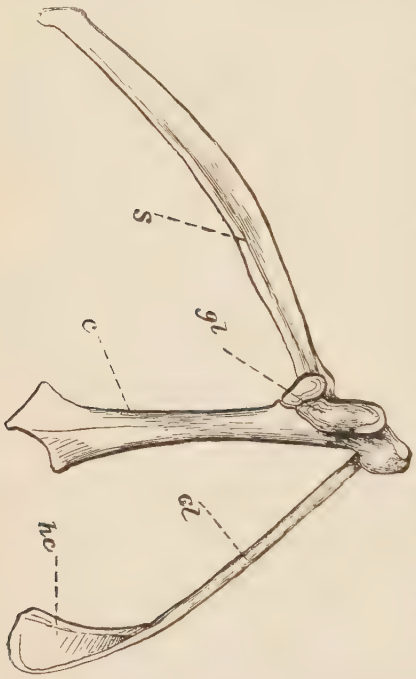


FIG. 59. — Right pectoral arch of a bird, *Pediœcetes phasianellus*, nat. size, outside view; Dr. R. W. Shufeldt, U. S. A. *s*, scapula; *c*, coracoid; *gl*, glenoid, the cavity for head of humerus; *cl*, clavicle: *hc*, hypocleidium. *In situ*, the right end of the figure should tilt up a little; see fig. 56.

The Scapula (Lat. *scapula*, the shoulder-blade; figs. 56, 59, *s*) merits in birds its name of "blade-bone," being usually a long, thin, narrow, sabre-like bone, which rests upon the ribs — usually not far from parallel with the spinal column, and near it; but in *Ratitæ* otherwise. It seldom gains much width, and is quite thin and flat in most of its length; but it has a thickened head or handle, expanding outwards into a *glenoid process* which unites with that of the coracoid to complete the glenoid cavity, and dilated inward to form an *acromial* (Gr. ἀκρώμιον, *akromion*, point of the shoulder) *process* for articulation with the clavicle (as it does in man), when that bone exists. The other end is usually sharp-pointed, but may be obtuse, or even clubbed, as in a woodpecker. The scapula is broadest and most plate-like in the penguins, in which birds all the bones of the flipper-like wing are singularly flattened. In *Apteryx* it reaches in length over only a couple of ribs; in most birds, over most of the thorax; and in some its point overreaches the pelvis.

The Clavicles, or Furculum (Lat. *clavicula*, a little key: *furculum*, a little fork; figs. 56, 59, *cl*), or the clavicular arch, are the pair of bones which when united together form the object well known as the "merry-thought" or "wish-bone," corresponding to the human "collar-bones." They lie in front of the breast, across the middle line of the body like a V or U; the upper ends uniting as a rule both with scapula and coracoid. For this purpose, in most birds, the ends are expanded more or less; such expansion is called the *epicleidium* (Gr. *ἐπί*, *epi*, upon; *κλειδίον*, *kleidion*, the collar-bone); in Passerine birds it is said to ossify separately, and is considered by Parker to represent the *procoracoid* of reptiles. At the point of union below, the bones often develop a process (well shown in the domestic fowl) called the *hypocleidium* (Gr. *ὑπό*, *hypo*, under; fig. 59, *hc*), supposed to represent the *interclavicle* of reptiles. The clavicles are as a rule present, perfect, anchylosed together, articulated at the shoulder; in a few birds anchylosed there; in several, there and with the keel of the sternum; in *Opisthocomus* there and with the manubrium of the sternum. In various birds, chiefly Picarian and Psittacine, they are defective, not meeting each other. They are wanting in *Struthio*, *Rhea*, *Apteryx*, and some *Psittacidæ*. Besides curving toward each other, the clavicles have usually a fore-and-aft curvature, convex forward. In general, the strength of the clavicles, the firmness of their connections, and the openness of the V or U, are indications of the volitorial or natatorial power of the wings. The end of the furculum is hollowed for a fold of the windpipe in the crested pintado (Owen).

4. *THE PELVIC ARCH.*

The Pelvis (Lat. *pelvis*, a basin, fig. 60), is that posterior part of the trunk which receives the uro-genital, and lower portion of the digestive, viscera. It consists of the "sacral" vertebræ on the middle dorsal line, flanked on each side by the bones of the *pelvic arch*, which supports the hind limb. In vertebrates generally the pelvic basin is completed on the ventral aspect by union (*symphysis*; Gr. *σύν*, *sun*, together; *φύσις*, growth) of the bones from opposite sides. Excepting only *Struthio*, which has a pubic symphysis; and *Rhea*, which has an ischiac symphysis just below the sacral vertebræ, the pelvis of a bird is entirely open below and behind; each pelvic arch anchylosing firmly with the sacral vertebræ to form a roof over the viscera above named. This sacro-iliac anchylosis is commonly coextensive with the confluence of the many vertebræ which make the "sacrum" of ordinary language, that is, from the first dorso-lumbar to the last uro-sacral. The whole roof-like affair looks something like a keelless sternum inverted. The pelvic arch of each side consists of three bones, *ilium*,

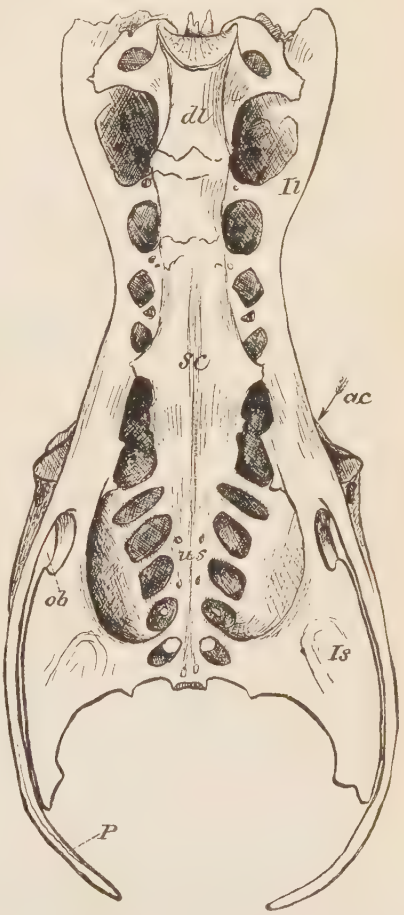


FIG. 60. — Pelvis of a heron (*Ardea herodias*), nat. size, viewed from below; from nature by Dr. R. W. Shufeldt, U.S.A. *dl*, dorso-lumbar vertebræ to and including the last one, *sc*; below *sc*, for the extent of the *large* black spaces (opposite the arrow) are the true sacral vertebræ; *us*, urosacral vertebræ (opposite the five oval black spaces; *Il*, ilium; *Is*, ischium; *P*, pubis; *ob*, obturator foramen. The arrow flies into the acetabulum.

ischium, and *pubis*, which have independent ossific centres, but become firmly consolidated together to form the haunch-bone or *os innominatum*. Each of these bones unites with the other two, somewhere near the middle of the whole affair, at a ring-like structure called the *acetabulum* (Lat., a vinegar-cruet, fig. 56, *a;* fig. 60, arrow *ac*), which all three consequently contribute to the formation of, and which is the socket for the head of the thigh-bone (*femur*, p. 119). When free ribs issue from under cover of the pelvis, they are commonly anchylosed with the ilia; and all the abortive pleurapophyses of the lumbar and uro-sacral vertebræ have likewise iliac anchylosis, as explained in treating of the sacrum (p. 140). As a whole, the pelvis varies like the sternum in relative length, breadth, and degree of convexity; and especially in the configuration of its posterior border; but few zoölogical characters are derived from this structure.

Viewed from below, the pelvis is seen to be much hollowed or excavated for the lodgment of the kidneys, and cross-cut into compartments by the sacral rafters; the series of sacral bodies forming a ridge-pole along the middle line. Above, the series of sacral spinous processes represent the ridge-pole; anteriorly, the somewhat spoon-shaped iliac bones are applied, concavity outward, to the dorso-lumbars; posteriorly, in the middle line, is a more or less flattened horizontal expansion, and laterally are the more expanded sides of the ischiac roof, finished along the eaves and behind by the slender pubic bone, which commonly projects backward, and inclines toward its fellow of the opposite side. The most prominent formation of the side wall of the pelvis is the thick-lipped smooth articular ring, the *acetabulum*, converted in the natural state into a cup by a membrane. The postero-superior segment of the rim is prominent, to form the *antitrochanter* (Gr. *ἀντί*, *anti*, against; *τροχαντήρ*, *trochanter* of the femur) against which the shoulder of the femur abuts when the head is in the ring.

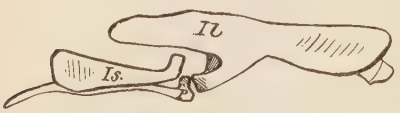


FIG. 61. — Pelvis of *young* grouse, showing three distinct bones. *Il*, *Is*, *P*, ilium, ischium, pubis. In front of former a dorsal vertebra protrudes. (Dr. R. W. Shufeldt, U. S. A.)

It is normal to recent Carinate birds to have the ischium fused with the ilium, however distinct the pubis may remain; but to Cretaceous birds (even the carinate *Ichthyornis*), and the existing *Ratitæ*, to have both ischium and pubis distinct in most of their extent.

The Ilium (Lat. *ilium*, haunch-bone; pl. *ilia;* adj. *iliac;* figs. 56, *I;* 60, 61, *Il*) is the median, most anterior and longest of the haunch-bones, and the only one which extends in advance of the acetabulum. Such anterior prolongation of this bone is the specialty of the avian pelvis: it commonly overlies one or more ribs, and is often overreached by the end of the scapula. It is longest and narrowest and flattest in some of the lower swimmers; the reverse among the highest birds. Its relations and connections have been sufficiently indicated. The bone is almost always separated from its fellow by the sacrum, though the approximation may be very close over the back of the pelvis, along the middle line.

The Ischium (Gr. *ἰσχίον*, *ischion*, the haunch-bone; pl. *ischia;* adj. *ischiadic*, *ischiatic*, better *ischiac;* figs. 56, 60, 61, *Is*) lies entirely post-acetabular, or behind the socket which it contributes to form, and composes most of the side-wall of the pelvis thence to the end. It is generally a thin, plate-like bone. Among Cretaceous birds and existing *Ratitæ* it only unites with the ilium at and just behind the acetabulum, whence a deep *ilio-ischiac* fissure between the two exists, as in the *young* grouse, fig. 61; but in ordinary adult birds this fissure is converted into a fenestra or window of large size, just behind the acetabulum, by union of the two bones behind it. This vacuity, whether a notch or a hole, corresponds to the "sacro-sciatic notch" of human anatomy (fig. 56, *in*). The ischia of opposite sides are distinct, except in *Rhea*.

The Pubis (Lat. *pubis*, bone of the front of the human pelvis where the hair grows at *puberty*; pl. *pubes*; adj. *pubic*; figs. 56, 60, 61 *P*), beginning at its share of the acetabular ring, is a long slender bone which runs along the lower border of the ischium, sometimes for a short distance only, often for the whole length of the ischium, and usually projecting behind; more or less perfectly parallel with, applied to, or united with, the inferior ischiac border. When separate, a long deep fissure results; when united at the end, a long narrow foramen is formed; when incompletely united in any part of its ischiac continuity, a fissure and a foramen, in the ostrich two foramina, result. All these conditions occur; in any case, such ischio-pubic interval corresponds to the *obturator* foramen (fig. 56, *o*; fig. 60, *ob*) of human anatomy; it is greatest in Cretaceous birds and existing *Ratitæ*. The free ends of the pubes may be more or less expanded. In the ostrich only there is a pubic symphysis of the ends of the bones; in the same bird a separate ossicle, situated upon the lower border of the pubes, and called *epipubic*, is considered to represent a "marsupial" bone (Garrod). In various birds, among them our ground cuckoo, *Geococcyx californianus*, the pubis projects a little forward, under the acetabulum: this prominence is the *propubis*. Separation of the pubes is supposed to be for amplification of the pelvic strait to facilitate the passage of the large chalky eggs birds lay.

5. *THE SKULL.*

The Skull of a Bird is a poem in bone — its architecture is the "frozen music" of morphology; in its mutely eloquent lines may be traced the rhythmic rhymes of the myriad amœbiform animals which constructed the noble edifice when they sang together.[1] The poësy (*ποίησις, poiesis*, a making) of the subject has been translated with conspicuous zeal and success by Mr. W. K. Parker; its zoölogical moral has been similarly pointed by Professor Huxley; and the young ornithologist who would not be hopelessly unfashionable must be able to whistle some bars of the cranial song — the pterygo-palatine bar at least.

The rapid progress of ossification soon obliterates most of the original landmarks of the skull, fusing the distinct territories of bone in one great indistinguishable area. Thus the brain-box of almost any mature bird is apparently a single solid bone, and most parts of the jaw-scaffolding similarly run together. Aside from the bones of the tongue, which are collectively separate from those of the skull proper; and of the compound lower jaw, which is freely articulated with the rest of the skull; only two or three other bones of the skull, as a rule, are permanently and perfectly free at both ends. These are the quadrate bones — the anvil-shaped pieces by which the lower jaw is slung to the skull; the pterygoids, articulating the palate with the quadrate; and sometimes the vomer. Traces only of the bones of the face and jaws are usually found; but even such vestiges disappear, as a rule, from among the bones of the brain-box. It is necessary to any intelligent understanding of the construction of a bird's skull, to learn somewhat of its mode of development in the embryonic stage; this being the only clue to the individual bones of which it is composed, and so to any correct idea of its morphology. One theory is, that the skull consists of four modified vertebræ; and the principal bones have been named and described by some in terms indicating the elements of a theoretical vertebra. It is true that the skull is segmented, or may be segmented off, like a chain of several vertebræ; that it continues the vertebral axis forward; that it has a *basis cranii* like a series of vertebral centrums, above which rises a segmented neural arch enclosing the great nervous mass, and below which depends a set of bones enclosing visceral parts like a hæmal arch. The hindmost cranial segment, the occipital bone, resembles a vertebra in many physical characters, and even in mode of development. But if the serial homology of the skull with

[1] Bone-tissue chiefly consists of the aggregated skeletons of *Osteamœbæ* — a kind of uni-cellular protozoan animals which inhabit in myriads the bodies of nearly all the *Vertebrata*, possessing the faculty of feeding upon phosphate of lime and other earthy matters they find in the blood, and afterward excreting them in the form of multiradiate exoskeletons of their own, collectively forming the whole skeleton of their host.

the back-bone be real and true, it is so obscured by the extraordinay modifications to which the vertebral elements have been subjected that the fact of such homology cannot be demonstrated; and to interpret the skull as something super-imposed upon, and morphologically different from the spinal column, is perfectly warranted if not required by the known facts of its constructive development. This is the view taken by the rulers of to-day's science. As already said (p. 137) the relation between cranial and vertebral parts is rather the analogy of adaptive modification than a true homology of structure.

Before proceeding to describe the mature skull, it will be best to consider its mode of development. In this I shall closely follow Parker, often using the words of that master, and illustrating the early stages of the embryo with figures borrowed from the same safe source. In the fewest words possible, I wish to convey an idea of the embryonic skull up to Parker's "third stage," at which it begins to ossify. Here, however, I will first insert a figure, kindly drawn for me by Dr. R. W. Shufeldt, of the U. S. Army, which shows most of the cranial bones, and will give the student a preliminary notion of the "lay of the land." I advise him to contemplate this picture till he has learned the names printed on it by heart, and can apply them to the identification of the parts of the real skull he should have in hand at the same time. He may also meditate on fig. 63.

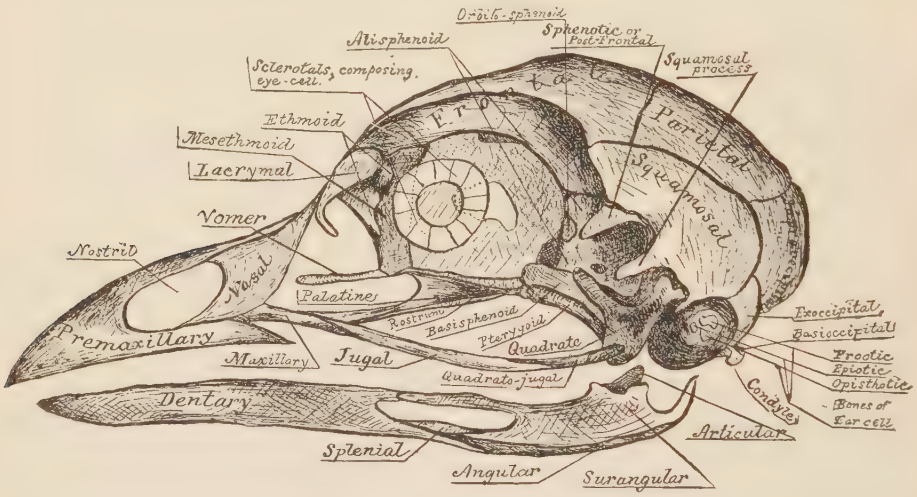


FIG. 62. — Skull of common fowl, enlarged; from nature by Dr. R. W. Shufeldt, U. S. A. The names of bones and some other parts are printed, requiring no explanation; but observe the following points: The distinction of *none* of the bones composing the brain-case (the upper back expanded part) can be found in a mature skull. The brain is contained between the *occipital*, *sphenoidals*, *squamosals*, *parietals* and part of *frontal*; the *ethmoidals* belong to the same group of cranial bones proper. All other bones, excepting the three *otic* ear-bones, are bones of the face and jaws. The lower jaw, of five bones, is drawn detached; it articulates by the black surface marked *articular* with the prominence just above — the *quadrate bone*. Observe that from this quadrate a series of bones — *quadrato-jugal*, *jugal*, *maxillary* — makes a slender rod running to the *premaxillary*; this is the *zygoma*, or *jugal bar*. Observe from the quadrate also another series, composed of *pterygoid* and *palatine* bones, to the premaxillary; this is the *pterygo-palatine bar*; it slides along a median fixed axis of the skull, the *rostrum*, which bears the loose *vomer* at its end. The under mandible, quadrate, pterygoid, and vomer are the only movable bones of this skull. But when the quadrate rocks back and forth, as it does by its upper joint, its lower end pulls and pushes upon the upper mandible, by means of the jugal and pterygo-palatine bars, setting the whole scaffolding of the upper jaw in motion. This motion hinges upon the elasticity of the bones of the forehead, at the *thin* place just where the reference-lines from the words "lacrymal" and "mesethmoid" cross each other. The dark oval space behind the quadrate is the external orifice of the *ear*; the parts in it to which the three reference-lines go are diagrammatic, not actual representations; thus, the quadrate articulates with a large *pro-otic* as well as with the *squamosal*. The great excavation at the middle of the figure, containing the circlet of unshaded bones, is the left *orbital cavity*, *orbit*, or socket of the eye. The *mesethmoid* includes most of the background of this cavity, shaded diagonally. The upper one of the two processes of bone extending into it from behind is the *post-frontal* or *sphenotic process*; the under one (just over the quadrate) is the *squamosal process*. A bone not shown, the *presphenoid*, lies just in front of the oval black space over the end of *basisphenoid*. This black oval is the *optic foramen*,

through which the nerve of sight passes from the brain-cavity to the eye. The black dot a little behind the optic foramen is the orifice of exit of a part of the *trifacial* nerve. The black mark under the letters "on" of the word "frontal" is the *olfactory foramen*, where the nerve of smell emerges from the brain-box to go to the nose. The nasal cavity is the blank space behind *nasal* and covered by that bone, and in the oval blank before it. The parts of the beak covered by horn are only *premaxillary*, *nasal*, and *dentary*. The *condyle* articulates with the first cervical vertebra; just above it, not shown, is the *foramen magnum*, or great hole through which the spinal medulla, or main nervous cord, passes from the skull into the spinal column. The *basioccipital* is hidden, excepting its condyle; so is much of the *basisphenoid*. The prolongation forward of the basisphenoid, marked "rostrum," and bearing the vomer at its end, is the *parasphenoid*, as far as its thickened under border is concerned. Between the fore end of the pterygoid and the basisphenoidal rostrum, is the site of the *basipterygoid process*, by which the bones concerned articulate by smooth facets; further forward, the palatines ride freely upon the parasphenoidal rostrum. In any Passerine bird, the *vomer* would be thick in front, and forked behind, riding like the palatine upon the rostrum. The palatine seems to run into the maxillary in this view; but it continues on to premaxillary. The *maxillo-palatine* is an important bone which cannot be seen in the figure because it extends horizontally into the paper from the maxillary about where the reference line "maxillary" goes to that bone. The general line from the condyle to the end of the vomer is the *cranial axis*, *basis cranii*, or base of the cranium. This skull is widest across the post-frontal; next most so across the bulge of the jugal bar.

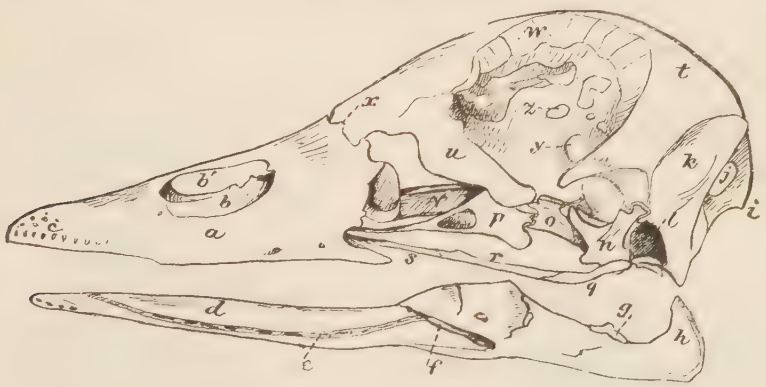


FIG. 63. — Skull of a duck (*Clangula islandica*, nat. size; Dr. R. W. Shufeldt, U. S. A. *a*, premaxillary bone; *b*, partly ossified internasal septum; *b'*, pervious part of nostril; *c*, end of premaxillary, perforated for numerous branches of second division of the fifth cranial nerve; *d*, dentary bone of under mandible; *e*, groove for nerves, etc.; *f*, a vacuity between dentary and other pieces of the mandible; *g*, articular surface; *h*, recurved "angle of the jaw;" *i*, occipital protuberance; *j*, vacuity in supraoccipital bone; *k*, muscular impression on back of skull; *l* is over the black ear-cavity; *m*, post-frontal process; *n*, quadrate bone; *o*, pterygoid; *p*, palatine; *q*, quadrato-jugal; *r*, jugal; *s*, maxillary; *t*, fronto-parietal dome of the brain-cavity; *u*, the lacrymal bone, immense in a duck, nearly completing rim of the orbit by approaching *m*; *v*, vomer; *w*, supra-orbital depression for the nasal gland (see p. 157); *x*, cranio-facial hinge; *y*, optic foramen; *z*, etc., interorbital vacuities.

Development of the Fowl's Skull (figs. 64 to 69). — In the chick's head cartilage is formed along the floor of the skull by the fifth day of incubation. This cartilaginous basilar plate is formed on each side of th *notochord*, fig 64, *c* (Gr. *νῶτον*, *noton*, back; *χορδή*, *chorde*, a chord), a rod-like structure, the primordial axis of the body, around which, along the spinal column, the bodies of the vertebræ are formed, and which runs in the middle line of the floor of the skull as far as the *pituitary space*, *pts*. The basilar plate is the *parachordal* (Gr. *παρά*, *para*, by the side of) cartilage. In this, at the earliest stage, are already planted certain parts of the ear, the *cochlea*, *cl*, (Lat. *cochlea*, a snail-shell), and the horizontal one of the three *semicircular canals*, *hsc*. Opposite the end of the notochord, the border of the parachordal plate is notched, 5; this notch afterward forms the *foramen ovale*, for the passage of parts of the *fifth* or *trifacial* nerve. Near the middle line, posteriorly, the plate is perforated for the passage of the twelfth or *hypoglossal* nerve, *q*. At each lateral corner is the separate *quadrate* cartilage, to form the quadrate bone. Anteriorly, the plate connects by a strap or bridge of cartilage, the *lingula*, *lg* (Lat. *lingula*, a little tongue) with the *trabeculæ*, *tr* (Lat. *trabecula*, a little beam), which enclose the *pituitary space*, *pts* (Lat. *pituita*, mucus: no applicability here). In front of this pituitary interval the trabeculæ come together to form an *inter-*

nasal plate, which is so arched over downward as to disappear from this view, as seen in fig. 65, where *fn* is the fronto-nasal process, and *n* is the future external nostril. After uniting in the fronto-nasal plate, the free ends of the trabeculæ separate and become free: their free ends are the under extremities of this *first visceral arch* (first and only pre-oral arch).

The same chick's head, now viewed from below, fig. 65, shows the squarish aperture, *m*, of the future mouth: the three post-oral arches, with their respective cartilaginous bars, out of which are to be formed the bones of the jaws and tongue. 1, 2, 3, are the corresponding *visceral clefts*, between the arches: the first of these is to be modelled into the ear-passages (outer and middle ear and eustachian tube): the others will disappear. The *quadrate* cartilage, *q*, is the same that was seen in fig. 64: it is already nearly in position, between the hind ends of the scaffolding of the upper and under jaw. The curved *subocular* or *maxillo-palatine* bar, *mxp*, developed in the first post-oral arch, already indicates anteriorly *palatine*, *pa*, and posteriorly, *pterygoid*, *pg*, parts: it will form the bones so named, and others of the

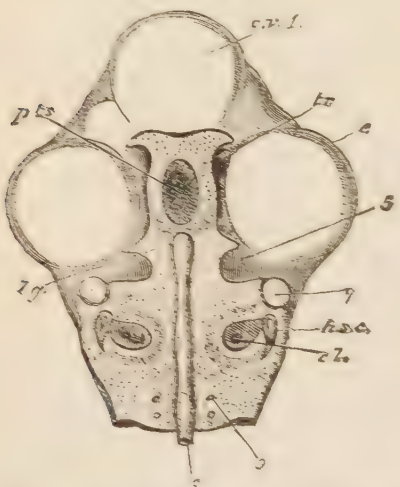


FIG. 64. — Skull of chick, fifth day of incubation, ×9 diameters. Seen from above, the membranous roof of the skull and the brain removed. *crl*, anterior cerebral vesicle; *e*, eye; *c*, notochord, running through the middle of the basilar plate or parachordal cartilage, in which are already visible the rudimentary ear-parts, *cl*, the cochlea, *hsc*, the horizontal semicircular canal; *pts*, the pituitary space, bounded by *tr*, the trabeculæ, which come together before it to form the fronto-nasal plate, *fn*, in fig. 65; *lg*, *lingula* or bridge connecting trabeculæ with parachordal cartilage; 5, notch afterward becoming foramen ovale for passage of parts of the fifth (trifacial) nerve; 9, foramen for hypoglossal nerve; *q*, separate cartilage forming the future quadrate bone. (After Parker, in *Ency. Brit.*)

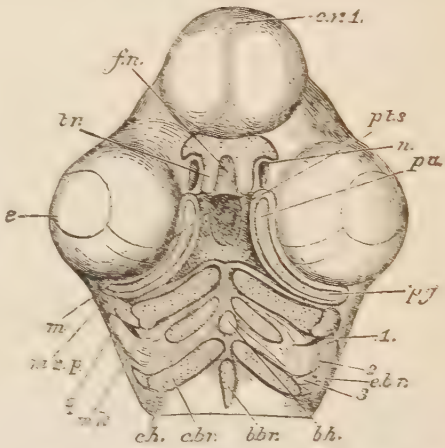


FIG. 65. — Same as fig. 64, but seen from below. *crl*, anterior cerebral vesicle; *e*, eye; *m*, mouth; *pts*, pituitary space; *fn*, fronto-nasal plate; *tr*, ends of the trabeculæ, free again after their union and bent strongly from the original axis of the trabeculæ; *n*, external nostril; *mxp*, subocular bar of cartilage, or pterygo-palatine rod, to form *pa*, palatine, and *pg*, pterygoid bone, and other parts of the upper jaw, as the maxillary, jugal and quadrato-jugal; *q*, quadrate cartilage, same as seen in fig. 64; *mk*, meckelian cartilage, to form lower jaw; these parts are in the first post-oral visceral arch; *ch*, cerato-hyal, and *bh*, basihyal, of second post-oral arch; *cbr*, cerato-branchial, *ebr*, epi-branchial, *bbr*, basi-branchial, of third post-oral arch; the parts of the second and third arch all going into the hyoid bone. 1, 2, 3, 1st, 2d, 3d visceral clefts, whereof the 1st is to be modified into the ear-passages, and the others are to be obliterated. (After Parker.)

upper jaw. This subocular bar is an antero-superior part of the first post-oral arch, of which *q* and *mk* are a postero-inferior portion; the cleft of the future mouth is to lie between them. The lower jaw bone, or *mandible*, is entirely developed from *mk*, its several bones developing around this rod of cartilage, the *meckelian* cartilage: it is to become movably articulated with the bone, the *quadrate*, into which *q* will be transformed. Thus the postero-inferior part of the first post-oral arch (second of the whole series of arches) begins in two pieces, one of which is to become the *suspensorium*, or suspender of the mandible, and the other the mandible

itself. The rest of the pieces belong to the *second* and *third* post-oral arches, and all together make up the very composite *hyoid* bone, or bone of the tongue (figs. 72, 73, 74). The pieces *ch* and *bh* are in the *second* arch, and form respectively the *ceratohyal* and *basihyal* bones; the pieces *cbr*, *ebr*, and *bbr* are in the third arch, and form respectively the *ceratobranchial*, *epibranchial* and *basibranchial* bones. These pieces of the third arch have already outgrown those of the second arch, and they will form the greatest part of the hyoid bone.

In the *second stage*, after the fifth day of incubation, but before any ossification has begun, a vertical section shows the appearances represented in fig. 66. The parachordal and trabecular cartilages are applied to each other unconformably, the latter rising high between second and third cerebral vesicles to form the posterior pituitary wall, *pcl*, in which the axial skeleton properly ends. There are other changes in the parachordal cartilages. The internasal plate, formed by the union of the trabeculæ in front of the pituitary space, has become a vertical median wall between the olfactory and optic chambers of the right and left sides (*pn* and *eth*, to *ps* and *alc*). This partition, besides forming finally the *interorbital septum* which divides the right and left orbits, will undergo further notable changes in direction, and will develop lateral plates and processes, which will make up the nasal labyrinth and the partition between the cavity of the nose and that of the eye, when any exists. Such lateral developments of the ethmoid plate are the *aliethmoid*, *aliseptal*, and *alinasal*. This plate extends backward in mid-line to the optic foramen, 2, ending in the *anterior clinoid* wall, *asc*, separated from the (parachordal) *posterior clinoid* wall by the original pituitary space, now the opening through which the carotid arteries, *ic*, enter the brain cavity. Besides ethmoidal parts proper, the plate develops at what will be the end of the upper beak a *prenasal cartilage*, *pn*, to become the axis of the beak. The mouth is become already better formed, the axis of its cavity pointing more forward than downward; and great changes are undergoing in parts of the ear at the back corner of the mouth. The quadrate and meckelian cartilages are assuming much of their true form. The quadrate develops an *orbital* process, which extends free into the orbit, and an *otic* process which articulates with the auditory sac and parts of the exoccipital cartilage. The relations at this stage have not been made out in the fowl, but are figured and described from the corresponding stage of the European house martin (*Chelidon urbica*). In fig. 67, *mk* is the cut stump of the meckelian cartilage, of which *ar* is the articular part; *q* is the quadrate, of which a backward process is seen articulating with *teo*, the tympanic wing of the exoccipital. Just below and behind this otic process of the quadrate, exactly where in riper embryos is the *fenestra ovalis* in which is fitted the foot of the *stapes* or stirrup-bone of the middle ear, there appears a trowel-shaped projection of cartilage, the handle of which is continuous with the substance of the ear-capsule; the sickle-shaped piece behind which is the tympanic wing of

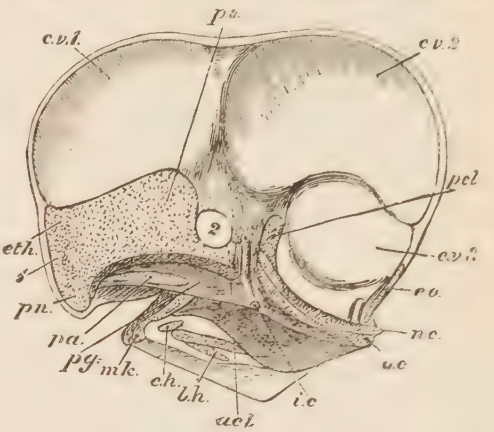


FIG. 66. — Head of a chick, second stage, after five days of incubation, section in profile; × 6 diameters. *cvl*, *cv2*, *cv3*, first, second, and third cerebral vesicles; 1, place of the first nerve, the olfactory; 2, place of second nerve, the optic; *ic*, internal carotid artery, running into skull at what was originally the pituitary space, now an opening bounded in front by the anterior, *acl*, behind by the posterior, *pcl*, clinoid walls; *nc*. notochord; *oc*, occipital condyle, thence to *pcl* being the original parachordal cartilage, here seen in profile; *eo*, exoccipital; *eth*, ethmoid, with *ps*, its presphenoid region posteriorly, and *pn*, pre-nasal part; this whole plate afterward developing into parts of the nose and the partition between the eyes; *pa*, palatine; *pg*, pterygoid region; *pa* and *pg* reference lines are in the chick's mouth; *mk* meckelian cartilage (lower jaw); *ch* and *bh*, ceratohyal and basihyal parts of the hyoid or tongue bone. (After Parker.)

the exoccipital (*teo*). This crowel of cartilage is the upper anterior segment of the hyoidean (second post-oral) arch, being to that arch what the pterygo-palatine bar is to the mandibular (first post-oral) arch. Several parts of this *stapedial* cartilage are recognized, as named in the fine print under the figure. If the connections of the second post-oral arch were completed, as those of the first are, the tongue bone would be slung to the skull as the lower jaw is; but they are not, the tract represented by the dot-line from the *stylo-hyal*, *sth*, to the *cerato-hyal*, *chy*, being, like *ist*, above *sth*, only soft connective tissue. This defect of connection is made up for by the great development of the hyoidean parts of the third post-oral arch, *br* 1 and *br* 2, which retain the tongue-bone in position, without however articulating it with the skull. The hand of the trowel of cartilage soon segments itself off from the ear-capsule, bringing away with it a small oval piece of the periotic wall, which piece is the true stapes, and the oval space in which it fits is the *fenestra ovalis* leading into the inmost ear (the *cochlea*). The broad part of the trowel-blade is the extra-stapedial part, on which the *membrana tympani*, or ear-drum, will be stretched. The stylo-hyal, *sth*, will join the extra-stapedial plate, and the afterward chondrified band of union will be the *infra-stapedial*, *ist*. (Figs. 71, *st*, and 83.)

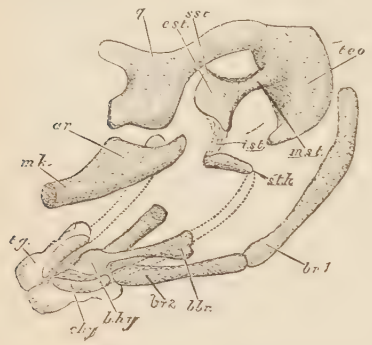


FIG. 67.—The post-oral arches of the house martin, at middle of period of incubation, lateral view, × 14 diameters. *mk*, stump of meckelian or mandibular rod, its articular part, *ar*, already shapen; *q*, quadrate bone, or suspensorium of lower jaw, with a free anterior orbital process and long posterior otic process articulating with the ear-capsule, of which *teo*, tympanic wing of occipital, is a part; *mst*, *est*, *sst*, *ist*, *sth*, parts of the suspensorium of the third post-oral arch, not completed to *chy*; *mst*, medio-stapedial, to come away from *teo*, bringing a piece with it, the true *stapes* or *columella auris*; the oval base of the stapes fitting into the future *fenestra ovalis*, or oval window looking into the *cochlea*; *sst*, supra-stapedial; *est*, extra-stapedial; *ist*, infra-stapedial, which will unite with *sth*, the stylo-hyal; *chy* and *bhy*, cerato-hyal and basi-hyal, distal parts of the same arch; *bbr*, *br* 1, *br* 2, basi-branchial, epi-branchial and cerato-branchial pieces of the third arch, composing the rest of the hyoid bone; *tg*, tongue. (After Parker.)

Returning now to the chick's head, which we left to examine the intricate ear-parts at the proximal end of the second post-oral arch, we see by fig. 68 how rapidly the parts are shaping themselves at the end of this second stage of development. This figure shows the cartilaginous skull, in which no trace of ossification has appeared, excepting in the under mandible. The brain and membranous parts of the cranium have been removed. The roof of the skull never becomes cartilaginous, bone there growing directly from the membrane; and the whole of the chondro-cranium, as shown in the figure, is one continuous cartilaginous structure (like the whole skull of an adult shark or skate), excepting the parts of the post-oral arches, which are separate. The auditory capsule is environed by occipital cartilage, *eo*, stretching over the back of the skull, and by wing-like growths (*alisphenoids*, *as*) which wall most of the brain-box in front. The high orbito-nasal septum is a continuous vertical plate of cartilage, upgrowing from the tract of the conjoined trabeculæ. Lateral developments of this ethmoidal wall, in

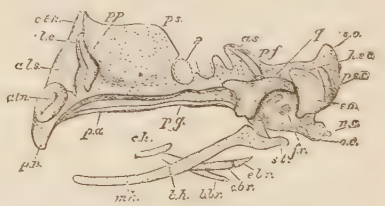


FIG. 68.—Skull of chick, second stage, in profile, brain and membranes removed to show cartilaginous formations, × 4 diameters. *eth*, ethmoid, forming median nose-parts and inter-orbital septum; developing lateral parts, as *ale*, aliethmoid, *als*, aliseptum, *aln*, alinasal, *pp*, partition between nose and eye; *pn*, prenasal cartilage; *ps*, presphenoidal part of mid-ethmoid; 2, optic foramen; *as*, alisphenoid, walling brain-box in front; *pf*, post-frontal, bounding orbit behind; *pa*, *pg*, palatine and pterygoid; *q*, quadrate; *so*, supra-occipital; *eo*, ex-occipital; *oc*, occipital condyle, borne upon basi-occipital, and showing *nc*, remains of notochord; these occipitals bound the foramen magnum, and *eo* expands laterally to form a tympanic wing, circumscribing the external auditory orifice behind and below; *hsc*, *psc*, horizontal and posterior vertical semicircular canals of ear; *fr*, *st*, fenestra rotunda and fenestra ovalis, leading into inner ear, latter closed by foot of the stapes; *mk*, *ch*, *bh*, *bbr*, *cbr*, *ebr*, parts of jaw and tongue, as named in figs. 65, 66 and 67. (After Parker.)

in front. The high orbito-nasal septum is a continuous vertical plate of cartilage, upgrowing from the tract of the conjoined trabeculæ. Lateral developments of this ethmoidal wall, in

front, are divided into several recognizable parts, *ale*, *als*, *aln*, the latter being the external nostril; *pp* is a transverse partition between the orbital and nasal chambers. The nasal cartilages ultimately become much convoluted to form the nasal labyrinth, among the convolutions of which will be the superior and inferior turbinal cartilages, in addition to those already noted. The ethmoidal wall ends behind at *ps*, the presphenoidal region, where the brain case begins; below and behind, it is deeply notched for the *optic* foramen, 2. The pituitary space forms a circular foramen, through which the carotid arteries enter. The site of the orbit of the eye is bounded behind and below by the postfrontal process of the alisphenoid wing, *pf* of *as*. The pterygo-palatine rod is seen along the under border of the skull, *pg* and *pa*. The quadrate, *q*, has acquired nearly its shape, and the rest of the mandibular and hyoidean parts are clearly displayed, *mk*, etc. The proximal hyoidean element, *st*, is freed from the periotic cartilage, leaving the fenestra ovalis (see last paragraph). Below the general outline, *pa* to *oc*, is not shown a mat of soft tissue, in which are to be developed the *basitemporal* and *parasphenoid* bones which underfloor the whole skull, — the former making a plat between the ears, fig. 69, *bt*, the latter forming the thickened under edge of the *rostrum* of the skull *rbs*.

At the third stage, about the middle of the second week of incubation, the cartilaginous parts already described are neatly finished, and the skull is beginning to *ossify*. The occipital parts are well formed; the condyle is perfect; the foramen magnum is circumscribed by the ex- and supra-occipitals, *eo* and *so*, fig. 69. Investing bones, formed in membrane without previous cartilage, are becoming apparent. The basitemporal, *bt*, and parasphenoid, *rbs*, are engrafting upon the base of the skull. The *prenasal cartilage*, *pn*, now at its fullest growth, is beginning to decline; on each side of it is formed a three-forked bone, the premaxillary, *px*, having superiorly nasal, and laterally palatal and dentary processes. This bone is to grow to great size, forming most of the upper beak, and starving out the maxillary, which in mammals is the principal bone of the upper jaw. The palatal, *pa*, and pterygoid, *pg*, bones are ossified, and the quadrate, *q*, is ossifying. Between the premaxillary and the quadrate are the bones forming the *zygoma*, or jugal bar, developed in the outer part of the maxillo-palatine bar of the earlier embryo. They are the weak *maxillary*, *mx*, with its ingrowing process, the *maxillo-palatine* bone, *mxp;* next the *jugal*, *j;* then the *quadrato-jugal*, *qj;* the

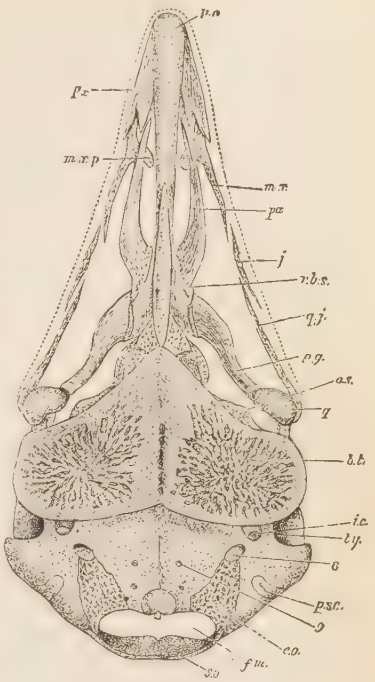


FIG. 69. — Skull of chick, third stage, viewed from *below*, × 6⅔ diameters. *pn*, prenasal cartilage, running behind into the septum nasi; on each side of it the premaxillary, *px*, of which the (inner) palatal and (outer) dentary processes are seen (the upper nasal process hidden); *mx*, the maxillary, developing inner process, the maxillo-palatine, *mxp; pa*, the palatal, well-formed, articulating behind with *rbs*, the sphenoidal rostrum, its thickened under border, the parasphenoid; this will bear the vomer at its end when that bone is developed; *j*, jugal, joining *mx* and *qj*, the quadrato-jugal, joining *j* and *q*, the quadrate; *mx* to *q*, the jugal bar or zygoma; *pg*, the pterygoid, making with *pa* the pterygo-palatine bar, joining *q* and *px; bt*, the basitemporal, great mat of bone from ear to ear, underflooring the skull proper, as *rbs*, a similar formation, does further forward; *ic*, outer end of carotid canal, to run between the *bt* plate and true floor of skull, and enter brain cavity at original site of pituitary fossa (figs. 64, 66, *ic*); *ty*, tympanic cavity — external opening of ear; *as*, alisphenoid, bounding much of brain-box anteriorly, and orbital cavity posteriorly; *psc*, posterior semicircular canal of ear, in opisthotic bone, which will unite with the spreading *eo*, exoccipital, which will reach the condyle shown in the middle line, above the foramen magnum, *fm*, completed above by *so*, supra-occipital; 8, foramen lacerum posterius, exit of pneumogastric, glosso-pharyngeal and spinal accessory nerve; 9, exit of hypoglossal nerve, in basi-occipital. (After Parker.)

whole forming an outer lateral rod from quadrate to premaxillary, like a duplicate of the pterygo-palatine rod from the same to the same.

Among occurrences of later stages are to be noted the development in membrane in the middle line below of the *vomer*, borne upon the end of the rostrum; the roofing in of the whole skull by the *parietal, squamosal, frontal* and *nasal* bones; the completion of the *periotic bones* as the *proötic, epiotic* and *opisthotic*, which form the *otic capsule;* the development of *lacrymal bones*, bounding the orbits of the eyes in front. Absorption of the middle wall of cartilage between the nasal and orbital cavities nicks off the nose parts from those of the orbit (fig. 70, between *ntb* and *eth*); and certain changes in the orbital septum develop the *orbito-sphenoids*. Very nearly all the bones of a bird's skull having thus been accounted for, we may next consider them in their adult condition. Reference should now be made to figs. 62, 63, 70, 71.

The Occipital Bone (fig. 62, 70, 71) forms the back part of the floor of the skull, and lower part of the back wall of the skull; neither its boundaries nor its composition is visible in adult skulls. It is formed by the *basioccipital, bo*, below in the middle line; the *supra-occipital so*, above in the middle line; the *exoccipital, eo*, on either side. These bound the *foramen magnum* (fig. 69, *fm*), where the nerve mass makes its exit from the cavity of the cranium into the tube of the spinal column. At the lower part of the foramen is the protuberant occipital condyle (figs. 68, 71, *oc*), borne chiefly upon the basioccipital, but to the formation of which the exoccipitals also contribute; the latter flare widely on each side, into the tympanic wings, which bound the external auditory meatus behind. The true basioccipital is mostly covered by the underlying secondary bone, the *basitemporal* (69, 70, *bt*), which extends from one tympanic cavity to the other, and more or less forward in the middle line to the sphenoidal rostrum. Openings to be observed in the occipital region, besides the great foramen, are those for the hypoglossal nerve, 9, near the condyle: for the parts of the vagus nerve, 8, more laterally, and the carotid canal, *ic*: also, above the foramen magnum, openings for veins, sometimes of great size, as in fig. 63, *j*.

The Parietals (figs. 62, and 70, *p*, 71). — Proceeding up over the brain-box, the next bones are a pair of parietals, between the occipital behind, the frontal before, and the squamosal beside; but their limits are rarely if ever to be seen in adult skulls. They are relatively small in birds; simply squarish plates, bounded as said, coming together in the midline.

The Frontals (fig. 62, and 70, *f*, 71), originally paired, soon fuse together, and with surrounding bones of the skull, though maintaining some distinction from those of the nose and jaw. These roof over much of the brain cavity, close in much of it in front, and form the roof and eaves of the great orbital sockets. Anteriorly in the middle of the forehead line the feet of the nasal process of the premaxillary are implanted upon the frontal, usually distinctly; more laterally, the nasal bones are articulated or anchylosed: this fronto-naso-premaxillary suture forming the fronto-facial hinge, (fig. 63, *x*) by the elasticity or articulation of which the upper jaw moves upon the skull, when acted on by the palatal and jugal bars. In the midst of the forehead the two halves of the frontal sometimes separate, as they do in the fowl, allowing a little of the mesethmoid to come to the front. In the middle line, underneath, the frontals fuse with whatever extent there may be of the mesethmoid which forms the lengthwise inter-orbital septum, and often a crosswise partition between the orbital and nasal cavities. To the antero-external corners of the frontal are articulated or anchylosed the lacrymals. The *post-frontal process*,[1] morphologically the post-frontal or sphenotic bone, bounds the rim of the orbit behind;

[1] There is apparently some ambiguity in the use of the term "post-frontal" process by different authors. It would appear that this process, bounding the rim of the orbit behind, may be a projection of the frontal bone, and therefore strictly a post-frontal process. Or that, as said by Owen for *Rhea*, it may be a separate bone, and there-

it is usually quite prominent. The frontal rim of the orbit in many birds shows a crescentic depression (very strong in a loon and many other water birds; fig. 63, *w*), for lodgment of the supra-orbital gland, the secretion of which lubricates the nasal passages. The cerebral plate of the frontal is often imperfectly ossified, showing large "windows" besides the regular openings for the exit of nerves which are always found at the back of the orbit. View from above, the frontal is vaulted and expanded behind, over the brain cavity, then pinched more or less, sometimes extremely narrow over the orbits, then usually somewhat expanded again at the fronto-facial suture. The extent of the frontal between the orbits and face, in the lacrymal region, is very great in the duck family, as seen in fig. 63.

The Squamosal (Lat. *squama*, a scale; figs. 70, 71, *sq.*) bounds the brain-box laterally, between occipital, parietal, frontal and sphenoidal bones, its distinction from all of these being obliterated in adult life. It is situated near the lower back lateral corner of the skull, forming some part of the cranial wall just over the ear-opening, and a strong eaves for that orifice. It is firmly united also to the bones of the ear proper, and receives the larger share of the free articulation which the quadrate has with the skull. It often develops a strong forward-downward spur, the squamosal process (fig. 62), looking like a duplicate post-frontal process; between these two is the *crotaphyte depression*, corresponding to the "temporal fossa" of man, in which lie the muscles which close the jaws. It scarcely or not enters into the orbit, the adjacent part of the orbit being alisphenoidal.

The Periotic Bones (Gr. *περί, peri*, about; *οὖς, ὠτός, ous, otos*, the ear; fig. 70) are those that form the *petrosal bone* (Lat. *petrosus*, rocky, from their hardness), or bony periotic capsule, containing the essential organ of hearing. When united with each other and with the squamosal, they form the very composite and illogical bone called "temporal" in human anatomy. There are three of these otic bones, — an anterior, the *pro-otic;* a posterior and inferior, the *opisthotic* (Gr. *ὄπισθε, opisthe*, behind) and a superior and external, the *epiotic.* They can only be studied in young skulls, upon careful dissection; they do not appear upon the outside of the skull at all, excepting a small piece of the opisthotic, which there fuses indistinguishably with the exoccipital. But somewhat of these bones are seen on looking into the cavity of the outer ear, and if the fenestra ovalis can be recognized, it determines a part of the boundary between the proötic and opisthotic bones, while the fenestra rotunda lies wholly in the latter. The cavity of the periotic bone is hollowed for the labyrinth of the internal ear, including the cochlea, which contains the essential nervous organs of hearing, and the three semicircular canals — so much of them as does not invade surrounding bones. In the young fowl's skull viewed internally (fig. 70), Parker figures a very large proötic portion (*po*) of the periotic, perforated by the internal auditory meatus (7) for the entrance from the brain of the auditory nerve; below and behind the proötic a small opisthotic (*op*), in relation with the exoccipital, upon the surface of which it also appears, outside (fig. 69, at *psc*), and with which it blends; a very small epiotic centre (*ep*), between the proötic and supraoccipital; and the anterior semicircular canal (*asc*) embedded in the latter. In Dr. Shufeldt's figure the otic elements are merely noted diagrammatically. According to Huxley's generalization, the epiotic is in special relation with the posterior semicircular canal; the proötic with the anterior vertical canal, between which and the foramen ovale (5) for the lower divisions of the trifacial nerve it lies. That part on which the inner foot of the quadrate is implanted is proötic. Below the drooping eaves of the squamosal, before the flaring wing of the exoccipital, and behind the quadrate bone, is the always decided and considerable cavity of the ear, bounded pretty sharply by the squamosal and exoccipital rim,

fore properly a *post-frontal bone.* Or, again, that it may have nothing to do with the frontal bone, but belong to the alisphenoid, as a process of the latter or a separate ossification; in which case it would be properly the *sphenotic.* In no event has it anything to do with the *squamosal* process lettered as such in fig. 62.

sloping with less distinction in front toward the orbital cavity. In this auditory hollow may be seen several openings: the *meatus* or proper ear-passage, through which, in one direction, a bristle may be passed to emerge at or near the middle line of the base of the skull, about the root of the basisphenoidal rostrum. Such a passage is through the *first visceral* cleft of the early embryo, modified into *meatus auditorius* and *eustachian tube*, which latter communicates with the back part of the mouth. Besides the other ear-passages proper, may be found other openings of air-passages leading into the interior diploic tissue of bones of the skull, and especially into the lower jaw bone. The ear-parts are immensely developed in owls, in many species of which they are unsymmetrical, that is, not sized and shaped alike on right and left sides of the head.

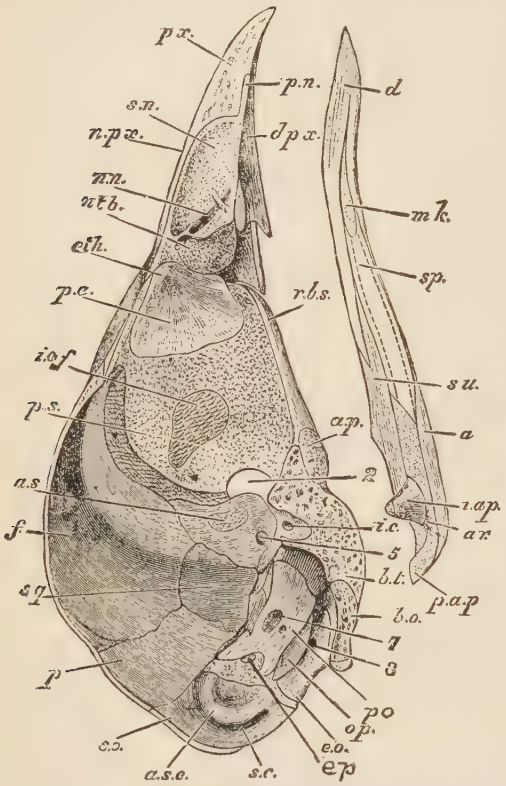


FIG. 70. — Ripe chick's skull, longitudinal section, viewed *inside*, × 3 diameters; after Parker. In the mandible are seen: *mk*, remains of meckelian rod; *d*, dentary bone; *sp*, splenial; *a*, angular; *su*, surangular; *ar*, articular; *iap*, internal articular process; *pap*, posterior articular process. In the skull: *pn*, the original prenasal cartilage, upon which is moulded the premaxillary, *px*, with its nasal process, *npx*, and dentary process, *dpx*; *sn*, septo-nasal cartilage, in which is seen *nn*, nasal nerve; *ntb*, nasal turbinal; the reference line crosses the *cranio-facial suture*, the face parts and cranial parts being nearly separated here by the nick seen in the original cartilaginous plate; *eth*, ethmoid; *pe*, perpendicular plate of ethmoid, which will spread nearly throughout the dotted cartilaginous tract in which it lies, to form nearly all the interorbital septum; transverse thickening (in some birds) below the reference line *eth* will form the pre-frontal, or orbito-nasal septum; *iof*, inter-orbital foramen; *ps*, pre-sphenoidal region, just above which is the orbito-sphenoidal region; 2, optic foramen; *as*, alisphenoid, with 5, foramen for divisions of the 5th (trifacial) nerve; *f*, frontal; *sq*, squamosal; *p*, parietal; *so*, superoccipital; *asc*, anterior semicircular canal; *sc*, a sinus (venous canal); *ep*, epiotic; *eo*, exoccipital; *op*, opisthotic; *po*, proötic, with 7, meatus auditorius internus, for entrance of 7th nerve; 8, foramen for vagus nerve; *bo*, basioccipital; *bt*, basitemporal; *ic*, canal (in original pituitary space; fig. 66 *ic*) by which carotid artery enters brain cavity; *ap*, basipterygoid process; *ap* to *rbs*, rostrum of the skull, being the parasphenoid bone underflooring the basisphenoid and future perpendicular plate of ethmoid. (The scaffolding of the upper jaw not shown, excepting *px*, &c.)

The Sphenoid (Gr. σφήν, *sphen*, a wedge; εἶδος, *eidos*, form; figs. 62, 70, 71) is a compound bone, not easy to understand as it occurs in birds, as much of it is hidden from the outside, some of it is very slightly developed, and all of it is completely consolidated with surrounding bones in the adult. It is wedged into the very midst of the cranial bones proper, with its body in the middle line below, next in front of the basioccipital, and its wings spread on either side in the orbital cavity. A sphenoid consists essentially of the *basisphenoid*, or main part of the bone (fig. 62); the *alisphenoids* or "wings," on either side (figs. 70, 71, *as*); the obscure *presphenoid*, (*ps*) in the middle line in front of and above the main body; and the small *orbito-sphenoids*, which are in fact the wings of the presphenoid. The body is usually covered in by the underflooring of the basitemporal; it is a flat triangular plate, produced more or less forward in the middle line as the *basisphenoidal rostrum*, or beak of the skull. This *rostrum* is an important thing. It forms, in fact, the central axis of the base of the skull; with the mesethmoid plate the inferior border of the interorbital septum, usually

thickened by the underflooring of the *parasphenoid* (fig. 70, *rbs*). The rostrum often bears on each side a *basipterygoid process* (*ap*), — a smooth facet with which the pterygoid articulates. These processes may be very strong, and far back on the basisphenoid body, when the pterygoids articulate with them near their own posterior ends, as in the struthious birds and tinamous (fig. 75, *btp*); or they may be further along on the rostrum, and the pterygoids then articulate near or at their fore-ends. The rostrum may be produced far forward, beyond the maxillo-palatines and vomer even, as in an ostrich; or it may bear the vomer at its end; or may be embraced by forks of the vomer; the palatines may glide along it, or be remote from it on either side. In any event, whatever its production, whatever part may be ethmoidal, or basisphenoidal, or parasphenoidal thickening, pterygo-faceting, etc., this "beak" of the basisphenoid is always in the axis of the base of the skull, and at the bottom of the interorbital plate; it may be horizontal, or obliquely ascending forward; and the variety of its relations with the pterygo-palatine and vomerine mechanism furnishes important zoölogical characters, as we shall see when we come to treat of palatal structure particularly. Just at the base of the beak, where it widens into the main body of the bone, may commonly be seen, coming from between the sphenoidal body and the lip of the basitemporal underflooring, the orifices of the eustachian tubes, and often also the anterior ends of the carotid canal. If a bristle, passed into a questionable foramen here, comes out of the ear, it has gone through the eustachian tube; if it comes out below the ear, on the floor of the skull, outside, it has run in the carotid canal. The extent of the *alisphenoids* (figs. 70, 71, *as*) cannot be determined in old skulls. They lie at the back lower border of the orbital cavity, closing in most of the brain box that is not foreclosed by the frontal bone. You will *always* find at the back of the orbit, close to the mid-line, and rather low down, the very large *optic foramina* (any figs., 2); alisphenoid should not extend in front of these orifices. A little below and behind the optic foramina, and much more laterally, not far from the quadrate itself, is a considerable foramen, quite constant, for transmission of the inferior divisions of the *fifth* (*trigeminal* or *trifacial*) nerve. This is the *foramen ovale* (any figs., 5); it is either *in* the alisphenoid, or between that bone and the proötic; it must not be mistaken for one of the several smaller holes, usually seen close about the optic foramen, which transmit the nerves (oculo-motor, pathetic,

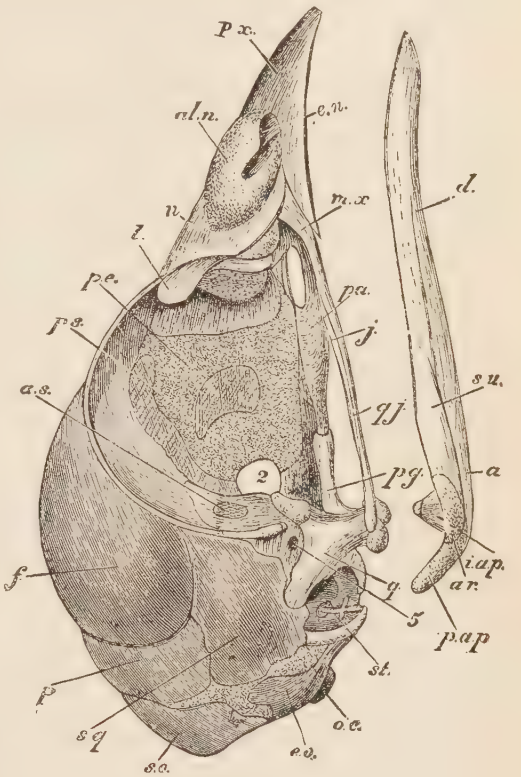


FIG. 71. — Ripe chick's skull, in profile, × 3 diameters; after Parker. *px*, premaxillary; *aln*, ali-nasal cartilage; *en*, septo-nasal; *n*, nasal bone; *l*, lacrymal; *pe*, perpendicular plate of ethmoid, as in fig. 70; *ps*, presphenoidal region: *as*, alisphenoid; *f*, frontal; *p*, parietal; *sq*, squamosal; *so*, superoccipital; *eo*, exoccipital; *oc*, occipital condyle; *st*, the cross-like object, the stapes, whose foot fits fenestra ovalis, see fig. 83; *q*, quadrate; *pg*, pterygoid; *qj*, quadrato-jugal; *j*, jugal; *pa*, palatine; *mx*, maxillary. In the mandible: *d*, dentary; *su*, surangular; *a*, angular; *ar*, articular; *iap*, internal angular process; *pap*, posterior angular process. 2, optic foramen; 5, foramen ovale, for inferior divisions of the 5th nerve. (Compare fig. 70.)

and abducent) which move the muscles of the eyeball; these holes being collectively about equivalent to the *foramen lacerum anterius* of human anatomy. Parts about the optic foramen, before and above, are presphenoidal (figs. 70, 71, *ps*) and orbito-sphenoidal; but they are obscure to all but the embryologist, and practically furnish no zoölogical characters.

The Ethmoid (Gr. *ἠθμός*, *ethmos*, a sieve; from the way it is perforated in the human species; fig. 62) is the bone of the mid-line of the skull, in front of the sphenoidal elements and below the frontal; it is in special relation with the olfactory nervous apparatus, or sense of smell. This is not an easy bone to "get the hang of" in birds. Referring to figs. 66, 68, *eth*, the student will see in the early embryo a high thin plate of cartilage, the *mesethmoid* cartilage, which is developing lateral processes to form the convoluted walls of the nasal passages. By the uprising and forth-growing of the prenasal cartilage, the mesethmoidal plate is tilted backward, as it were, under the frontal. Next, by absorption of tissue just opposite the future cranio-facial suture, the plate is nicked apart, the portion in front of the nick elaborating the nasal chambers, which usually remain cartilaginous, and the portion behind this nick becoming the permanent plate, fig. 70, *eth*, *pe*, to which the name *mesethmoid* or mid-ethmoid is more strictly applicable. Practically, a bird's ethmoid is chiefly the inter-orbital septum, in vertical mid-line between the orbits, with such flange-like processes or lateral plates as may be developed to form an *orbito-nasal* septum separating the eye-socket from the nose-chamber. In general, the permanent ethmoidal plate becomes nearly coincident with this orbital wall, and pretty well cut off from the osseous or cartilaginous developments, when any, in the nasal cavities. It is then fairly under cover of the frontal, with which, as with the sphenoidal elements posteriorly, it becomes completely fused. When this inter-orbital septum is fully developed, it completely divides the right and left orbital cavities, and its lower horizontal border, fused with the basisphenoidal rostrum, may like the latter be thickened by bearing its share of the parasphenoidal splint. Oftener, however, this lower border slopes upward and forward, from the sphenoidal base to the roof of the skull about the site of the cranio-facial suture; and usually the septum is incomplete, having a membranous fenestra somewhere near its middle (fig. 70, *iof*). Along the upper border of the mesethmoid plate, or just in the crease between it and the overarching frontal may usually be seen a long groove, which, beginning behind at the *olfactory foramen* of the brain-box, conducts the thence-issuing olfactory nerve to the nasal chambers. Sometimes there is another such groove, from a similar foramen near by in the sphenoidal parts, which similarly traces the course of the ophthalmic (first) division of the trifacial nerve. Occasionally, as in the fowls, the two halves of the frontal bone separate a little at the extreme forehead, allowing the mesethmoid plate there to come up flush with the outer surface of the skull.

In some birds, as the low ostrich, for example, the original mesethmoidal cartilage-plate does not nick apart into orbital and nasal moieties, but ossifies as a continuous sheet of bone, dividing right and left halves of the skull far towards the point of the beak (see fig. 75, beyond *R* to *Pmx*). A nasal septum, separated from the orbital septum, may persist to ossify; forming, as in the raven, a vertical plate separate from all surroundings, and liable to be mistaken for a free *vomer* (see fig. 79, where the reference line *v* goes to it, instead of to the truncate vomer); or, as in many birds, a plate variously anchylosed with its surroundings. But these formations, as well as the various *turbinal* (Lat. *turbo*, a whorl) scrolls and whorls formed in this part of the skull, belong rather to the organ of smell than to the skull proper.

The Cranial Bones proper are all those thus far described, excepting the nasal ossifications just noted, which belong to the first pre-oral arch; and the stapedial parts of the ear, which belong to the hyoidean apparatus (second post-oral arch). Intermediate in some respects between the proper cranial bones and

The Facial Bones proper is the Vomer. — By "facial bones," as distinguished from "cranial" bones, is meant the entire bony scaffolding of the upper and lower jaws, and of the tongue, — parts developed in the pre-oral or maxillary, and first, second, and third post-oral, or mandibular, hyoidean proper, and branchial, arches.

The Vomer (Lat. *vomer*, a ploughshare; figs. 62, 63, 75 to 80, *v*) is considered, by those who hold the vertebral theory of the skull, to be the body of the foremost (fourth from behind — the basioccipital, basisphenoid, and presphenoid being the other three) cranial vertebra. So far from having any such morphological significance, it is one of the late secondary bones, developed, if at all, apart from the general make-up of the skull, as a special superaddition underlying the ethmoidal region, as the parasphenoid and basitemporal underlie the skull further back. Its character is extremely variable in the class of birds, though usually constant in the several natural divisions of the class, — a fact which confers high zoölogical value upon this anomalous bone. A vomer is a symmetrical mid-line bone of the base of the skull, found if at all at or near the end of the rostrum. It is originally double, i. e., of right and left paired halves. These halves persist distinct in the woodpeckers, and are remote from each other, one on each side of the mid-line (fig. 80). The vomer is wanting entirely in the Columbine birds, as the pigeons and some of their allies, as the sand grouse (*Pterocletes*) and bush quails (*Hemipodes*) of the old world, and in certain of the true *Gallinæ*. Its connections are various. It may be borne free upon the end of the rostrum. It may be applied like a splint by a grooved upper surface to the under side of the rostrum, and so fixed there; or, in such situation, it may glide along the rostrum according to the movements of the palatal parts with which it may connect. Thus, in the ostrich (fig. 75), it saddles the rostrum below, and is joined by the maxillo-palatines. Or, it may be united with separate ossifications, the septo-maxillaries, which in some birds bridge across the palate (fig. 80). The commonest case is its deep bifurcation behind (fig. 79), each fork uniting with the palate bone of its own side, and sometimes also with the pterygoid. Such is usually the fixture of the bone behind, and it then rides along as well as simply bestrides the rostrum. The anterior end of the vomer may be perfectly free, projecting into the floor of the nasal chambers (figs. 62, 77), or the fore end may be variously steadied or connected with maxillary processes (fig. 78). When free in front, and often when not, the vomer is a simple share-like plate, more or less expanded vertically, quite thin laterally, and "spiked," i. e., running forward to a point; under these circumstances it may or may not bifurcate behind, and be there attached to the palatines or not. But the commonest case of vomer, shown by the great Passerine group, which comprise the majority of recent birds, is different from this, the vomer being in front thickened, flattened and expanded laterally, and connected with nasal cartilages and ossifications (alinasals and turbinals). Such a vomer, deeply cleft behind to join the palatals, is endlessly diversified in the configuration of its fore end, which may be notched, lobed, clubbed, etc. The *general case* of such a vomer is indicated by the expression "vomer truncate in front," as distinguished from the simply pointed or "spiked" vomer. (For further details see description of the several patterns of palate-structure, beyond.)

The Quadrate Bone (Lat. *quadratus*, squared; figs. 62; 63, *n;* 64, 65, 68, 69, 71, *q;* 75, *Qu*), with which we may begin the jaw-bones proper, is the suspensorium of the lower jaw, — the perfectly constant and characteristic bone by means of which the mandible proper articulates with the skull. Its rudiment is seen in the earliest embryos, at the corners of the primordial parachordal cartilages. It belongs to the mandibular (first post-oral) arch, of which it is the proximal element. Its general morphology has caused much dispute. From the fact that in birds one of its functions is to support, in part, the tympanum of the ear, it has been identified with the *tympanic* bone of mammals, — that which in man forms the bony tube of the external auditory meatus. The view now generally accepted is, that the bird's quadrate repre-

sents, certainly in part, probably in whole, the little bone of the middle ear called the *malleus* in mammals. Anyhow this may be, the quadrate of a bird bears the proximal ends of *both* jaws, carrying their final (posterior) articulation up to the squamosal and petrosal bones. Thus, the foot of the quadrate forms the free hinge of the lower jaw, and also movably articulates the back end of both the zygomatic and the pterygo-palatine bars or "arcades." The head of the quadrate freely articulates with the squamosal, just in front of the tympanity cavity, which it thus bounds in front; and there is usually a shoulder which furthermore articulates with the anterior periotic bone, the proötic; Struthious birds do not have these two distinct facets. A long *pedicle* or *orbital process* extends forwards, inwards, and upwards in the orbit; this non-articular handle is for advantageous muscular traction. So circumstanced, the quadrate is a stocky bone, of a shape reminding one of an anvil; it rocks freely to and fro upon its cranial socket, pulling and pushing upon the whole maxillary and mandibular mechanism, with such effect that when the lower jaw drops, the zygomatic and palatal bars are automatically shoved forward, tending to make the upper jaw rise, and so increase the opening of the mouth. Such mobility of the upper jaw automatically with the movement of the lower is very free in parrots, whose cranio-facial connections are quite articular in character; it is well shown also in ducks; and probably nearly all birds have some such motion of the upper jaw upon the skull. In nearly all birds, the mandibular articular facet of the quadrate is divided by a lengthwise impression into inner and outer protuberances, or condyles, fitting corresponding depressions on the articular face of the lower jaw; in some birds the articular surface is single. The zygomatic articulation with the quadrate is made by the balled end of the quadrato-jugal socketed in a cup at the *outer* side of the mandibular facet (with various minor modifications in different birds). The palatal articulation is made by a little condyle of the quadrate, at the *inner* side of the main facet, socketed into the cupped end of the pterygoid (with minor modifications).

The Quadrato-jugal and Jugal Bones (Lat. *jugum*, a yoke; figs. 62, 63, *q*, *r*; 69, 71, *qj*, *j*) form most of the *outer* arcade — the *jugal* or *zygomatic* bar — leading from the quadrate bone to the beak. The quadrato-jugal is posterior, reaching a variable distance forward; at its fore end it is obliquely sutured to the jugal, a splint-rod which carries the bar forward to the maxillary bone, with which it is in like manner obliquely sutured. The whole affair is almost always a slender rod, which with its fellow of the opposite side forms the outermost lateral boundary of the skull for a great distance. It corresponds in general with the "zygomatic arch" of a mammal, which is made up of a "zygomatic process of the squamosal" and a malar or "cheek-bone." The whole zygomatic arch, including the maxillary bone itself, is developed from the outer part of the primordial pterygo-palatine bar (see fig. 65). In parrots the zygoma is movably articulated before as behind.

The Maxillary Bone (Lat. *maxilla*, upper jaw bone; figs. 62; 63, *s*; 69, 71, 75, *mx*), forming so much of the upper jaw of a mammal, is in birds greatly reduced, being starved out by the predominant premaxillaries which form most of the upper beak. The shape of this stunted bone varies too much to be concisely described. Its connections are, ordinarily, with the jugal behind by a long slender splint-like process, and with the premaxillary and usually the nasal bones in front and externally. Internally, it may or may not connect with the palatal and vomer. The zoölogical interest of this bone centres in certain inward (palate-ward) processes, often its most conspicuous parts, and apparently corresponding to the plate which in a mammal roofs the hard palate anteriorly. Though these are mere processes from the main maxillary, they are so distinct and important that they are commonly described as if they were independent bones, under the name of the *maxillo-palatines*. They are flange-like or scroll-like plates, or large spongy masses of delicate bone-tissue, — endlessly varied in configuration and context (see the various figures of base of skull, *mxp*, beyond, where the palate-patterns are described).

Certain other inward maxillary processes, which may or may not unite with the vomer, and so bridge over the palate, are called *septo*-maxillaries (fig. 80, *smx*); and in some woodpeckers yet other palate-processes appear (fig. 80, *pmx*).

The Pterygoid Bones (*Gr.* πτέρυξ, *pterux*, wing; εἶδος, *eidos*, form; figs. 62; 63, *o;* 65, 66, 68, 69, 71, 80, *pg;* 75 to 79, *Pt*). Returning now to the quadrate, and going along the inner arcade, we first encounter the *pterygoid*, — a generally rod-like, but variously twisted, crooked, or expanded bone which makes the connection between the quadrate behind and the palate bone before. The pterygoid is always freely jointed at both ends; its posterior quadrate articulation has been noted above; its anterior connection is usually by little nipper-like claws by which it "catches on" to the hind end of the palatine. In the ostrich (fig. 75, *Pt*) the pterygoid expands into a scroll-like plate; but its rod-like shape is usually preserved. Besides passing very obliquely inward as it goes forward from the wide-apart quadrates to the narrow rostrum in the axis of the skull, the pterygoid often bellies or elbows inwards in its course to join the basisphenoidal beak, and be movably articulated therewith. In the majority of birds, there is no such rostral articulation, or the pterygoid only touches the rostrum at its fore end where it joins the palatal. In many, however, special *articular facets*, called *basipterygoid processes* (fig. 70, *ap*), are developed on the rostrum for the pterygoids to abut against and glide over. In Carinate birds, excepting the tinamous (*Dromæognathæ*), these processes are forward on the beak, and the pterygoids articulate at or near their own fore ends, as well shown in the fowl or duck, figs. 77, 78, *Pt*. In Ratite birds and tinamous, the basipterygoids are very long, flaring transverse processes, far back on the rostrum, at the sphenoidal base, and the pterygoids articulate therewith at or near their own posterior ends (figs. 75, *Btp*, and 76).

The Palatal or Palatine Bones (Lat. *palatum*, roof of the mouth; figs. 62; 63, *p;* 65, 66, 68, 69, 71, 77, 78, 80, *pa;* 75, 76, 79, *Pl*) are a pair, approximately parallel and near the mid-line, forming that part of the "hard palate" or roof of the mouth which is not constructed by the palatal processes of the maxillaries, or vomer. They are nearly always long thin bones, among the most conspicuous parts when the dried skull is viewed from below. Sometimes, as in the ostrich (fig. 75, *pl*), they are remote from the axis of the skull and only connected in front with the maxillaries and maxillo-palatines. In many birds they skip the maxillary parts in going forward to be fused with the premaxillaries; in most, probably, they form anterior connections in one or another fashion with palatal parts both of maxillaries and of premaxillaries. Behind, they always correctly articulate with the pterygoid. The mid-line connections made in most Carinate birds (not in Dromæognathæ) are variously with the vomer, with the rostrum, with each other, or some or all of these relations at once. A long deeply-cleft vomer may by its posterior forks attach itself to the whole palatal mid-line, excluding the palatals from the rostrum; less extensive attachment of the same kind may permit the palatals to touch each other and the rostrum posteriorly, while cutting them off anteriorly; also, a non-cleft vomer may attach itself to the posterior extremity of the palatals, and bear them off the rostrum. The whole hard palate may fuse into an indistinguishable mass; and in almost any case the relations of the palatals to each other and their connections afford some of the most valuable zoölogical characters of great groups of birds. (Details figured and described beyond.) Though very variable in configuration, as well as in connections, certain parts of a palatal may usually be recognized, and conveniently named for descriptive purposes. Anteriorly, in the great majority of birds, of whatever technical kind of palatal structure, the palatals are simply prolonged as flat strap-like or lath-like bars running past the maxillary to the premaxillary region; and such simple band-like character may be preserved behind. Ordinarily, however, the palatals expand posteriorly, becoming more or less laminar; and in this plate-like part three surfaces may usually be recognized. One, more or less horizontal, flaring outward, is the

external lamina. It is well shown in a Passerine or Raptorial bird, where the *postero-external angle* (between the outer border and the posterior end of the palatal is well-marked, or may be acutely produced; there is no such lamina in a fowl, where the palatals are for the most part slender and rod-like. An internal, more or less vertically produced, plate to make the mid-line rostral or vomerine connection is the *superior internal lamina*, or *medio-palatine process;* very strong, for example, in a fowl, where it forms all the expanded part of the bone, and ends anteriorly as a sharp *inter-palatine spur*. The medio-palatine is probably to be regarded as the main body of the bone, being the most axial part, of the most extensive and varied connections. A third lip or plate of the palatal is the *inferior internal lamina*, looking downward; it is generally very evident, but in a duck or fowl is reduced to a mere ridge, indicating where the superior internal and external laminæ meet. A duck's palatals are quite different in appearance from those of most birds, all the posterior parts just distinguished being reduced and constricted, while the fore ends, running abruptly into the hard-boned beak, are much expanded horizontally (fig. 78). The postero-external angles of the palatal (formed by the external lamina), even when much produced, may not reach as far back as opposite the pterygo-palatine articulation; or they may surpass these limits, and when they do, such backward prolongation is called *post-palatine*, the palate being considered to end at the pterygoids. In like manner, the maxillary processes of the palatals, or the palatal strips as prolonged into the premaxillary region, are called *pre-palatines*. The inner posterior process, by which the palatine is articulated with the pterygoid, is its *pterygoid process*.

The Premaxillary Bones (figs. 62; 63, *a;* 69, 70, 71, 80, *px;* 75 to 79, *pmx*), also called **Intermaxillaries**, form most of the upper beak, attaining enormous development in birds, and reversing the usual relative size of premaxillary and maxillary. Mainly determining as they do the form of the upper mandible, their shapes are as various as the bills themselves of birds; but their generalized characters can be easily given. Each premaxillary, right and left, forms its half the bill; the two are always completely fused together in front, commonly preserving traces at least of their original distinction behind. They are commonly called one bone, *the* premaxillary. Each is a triradiate or 3-pronged bone; one upper prong, the most distinct, called the *nasal* or *frontal process*, forms with its fellow the culmen (p. 104, fig. 26, *b*) of the bill. These processes, side by side, run clear up to the *frontal* bone in birds, driving the nasal bones apart from each other. Such a *median* fronto-premaxillary suture, with lateral fronto-nasal and naso-premaxillary sutures, is highly characteristic of birds, — an arrangement probably exceptionless. Two other horizontal prongs on each side, extensively distinct from the frontal process in most birds, but less separate from each other, run horizontally along the side and roof of the mouth for a variable distance. These horizontal prongs are an *external* or *dentary* process (fig. 80, *dpx*), forming the tomium (p. 104) of the bill, and reaching back to join the dentary part of the maxillary; and an *internal* or *palatal process* (fig. 80, *ppx*), running along the commencement of the bony palate. With this latter the anterior ends of the palatal bones unite, — either on the side toward the mid-line of the beak, or between the palatal and dentary processes, as in a woodpecker (fig. 80). Great laminar expansions inward of these palatal parts of the premaxillaries roof the hard part of the mouth anteriorly, though there is usually a vacancy between the premaxillary hard palate and that formed farther back by the maxillo-palatines and palatines. The posterior extremities at least of the frontal processes of the premaxillaries are commonly distinguishable from each other, as well as from the frontal and nasal bones — in fact, these fronto-naso-premaxillary sutures are among the most persistent of all. The divergence of the frontal from the palatal and dentary processes bounds the external nostril in part, the circumscription of that orifice being completed by the prongs of the nasal bones. The superficies of the premaxillary bone, like that of the dentary piece of the lower jaw bone, is commonly sculptured with the impressions of the vessels and nerves which

ramify beneath the horny integument; and in birds with very sensitive bills, as a snipe or duck, the end is perforated sieve-like with little holes, into which the skin shrinks in drying, producing the familiar "pitted" appearance (fig. 63, at *c*).

The Nasal Bones (figs. 62; 71, *n*) might have been described next after the *frontals*, as they continue forward the general roofing of the skull; but are conveniently considered in the present connection, being in birds rather "facial" than "cranial." They are of large size in birds, and pronged, — one fork, the *superior process*, being applied for a variable distance along the outer side of the frontal process of the premaxillary, the other, *inferior*, descending to or towards the dentary border of the maxillary or premaxillary, or both; the divergence of these two processes bounding the nostril behind. The base of the nasal, uppermost and posterior, anchyloses (usually) or sutures (often) or articulates (as in parrots) with the antero-external border of the frontal bone; its frequent collateral connections being with the lacrymal or ethmoid, or both of these. The nasals are very variable in shape, as well as in the extent of their connections. When expansive, they may wall in much of the nasal cavity, as well as bound the nostrils. These latter openings, as far as the bony boundaries are concerned, are usually much more extensive than they seem to be from the outside, being much contracted by membrane and integument. Ordinarily, each forms a great vacuity, which the descending prong of the nasal bone separates from a similar vacancy between itself and the lacrymal, the lacrymal in turn interposing between this and the orbital cavity. The descending process of the nasal, in fact, is a marked object at the side of the base of the upper mandible of most birds, though slight or rudimentary in the Ratitæ. A character of the nasals has been employed in classification by Mr. Garrod. A bird having the bones as above generally described, with moderate forking, so that the angle of the fork, bounding the nostrils behind, does not reach so far back as the fronto-premaxillary suture, is termed *holorhinal* (Gr. ὅλος, *holos*, whole; ῥίς, ῥινός, *rhis*, *rhinos*, nose; fig. 62). But in the *Columbidæ*, and in a great many wading and swimming birds, whose palates are cleft (*schizognathous*), the nasal bones are *schizorhinal* (σχίζω, *schizo*, I cut); that is, cleft to or beyond the ends of the premaxillaries; such fission leaving the external descending process very distinct from the other, almost like a separate bone. Pigeons, gulls, plovers, cranes, auks, and other birds are thus split-nosed. The value of the character, except as an auxiliary, is doubtful.

The Lacrymal (Lat. *lacryma*, a tear; from the relation of the human bone to the tear-duct; figs. 62; 63, *u*; 71, *l*) is one of several splint-like membrane-bones of the skull, having little intimacy of relation with the general morphology of the cranium, though quite constant in birds, and often very conspicuous. It is situated at or near the anterior outer corner of the orbit, near the nasal but behind that bone; sometimes anchylosed, sometimes very loosely attached, oftener firmly sutured with the frontal; and may also have connection with the nasal and ethmoid. It is generally a claw-like affair, depending from the front outer corner of the frontal, and consequently bounding the orbit anteriorly; it may be variously twisted, crooked, hooked, etc. It is singularly elongated and distorted in the ostrich. In the duck tribe, in which the lacrymo-frontal region of the skull is greatly elongated, the lacrymal has coextensive attachment to the frontal bone, and is broadly laminar, with a downward process; in some ducks bounding at least a fourth of the orbital brim, and almost completing the circle by extending toward the very protrusive post-frontal process, as in fig. 63, *u*. In some parrots, the rim of the orbit is completed below, and even sends a bony bar to bridge over the temporal fossa behind the post-frontal. In some birds, the lacrymal is quite free, and even in more than one free piece. The *os uncinatum*, or *os lacrymo-palatinum*, would appear to be a palatine bone distinct from the lacrymal; it has been observed in the *Musophagidæ* and many other picarian birds, in *Tachypetes* and certain *Procellariidæ*. The lacrymal bone seems to be the prin-

cipal relic, in birds, of a set of splint-bones which lie about the edges of the orbits in many *Sauropsida*. Another is the post-frontal or sphenotic, usually a process of the frontal, often a separate ossification. In some birds, as various *Raptores*, there are one or more loose supra-orbital plates of bone, serving to eke out the brim of the orbits; thus forming the "orbital shields" so prominent in many hawks, and causing their eyebrows to project. Were such a a chain of splint-bones complete (lacrymal, superorbitals, post-frontal, and squamosal, to quadrate), it would form an arcade of bones *over* the orbit, like the actual zygomatic arch (maxillary, jugal, quadrato-jugal, to quadrate) which lies under the orbit; and such a double series is very perfectly illustrated in many of the *Sauropsida* below birds (Huxley).

Other special ossifications have been described in some birds, but I am obliged to pass them over. I have already far exceeded intended limits, and have yet to describe the mandibular and hyoidean arches, and the zoölogical characters of the palate as a whole.

The Mandible, or Lower Jaw Bone (figs. 62, 63, 70, 71) is a collection of bones developed in the first post-oral visceral arch. Each half of the compound bone (right and left) consists normally of *five* bones, which become immovably anchylosed, but traces of the original distinction of which commonly persist for an indefinite period, — in some birds throughout their lives. In an embryo whose skull has passed to the cartilaginous stage, a long slender rod of cartilage appears in the first post-oral visceral arch; this is *Meckel's cartilage*, or the *meckelian rod* (figs. 65, 66, 68, 70, *mk*), so named after a famous anatomist. Around this rod, which subsequently disappears, the several bones of the mandible are developed. The anterior one of these is the *dentary* (*d*), forming the scaffold of the horny part of the external under mandible. It usually unites by anchylosis, sometimes only by suture, with its fellow of the opposite side. This union in the middle line is the *symphysis* (Gr. *σύν*, *sun*, with; *φύσις*, *phusis*, growth). The line of union is externally the *gonys* (see p. 103), the length and other characters of which are determined by the mode of symphysis, as is the general shape of the tip of the lower mandible. The union generally makes an angular Λ, but may be an obtuse $\sqcap$; the symphysis is very short and imperfect, as in a pelican, for instance, or the opposite, as in a woodpecker and a multitude of birds. Behind the dentary, each ramus of the jaw continues with pieces called *splenial*, *angular* and *surangular* (*sp*, *a*, *su*): there is often a fenestra between them, by imperfection of bony union, as shown in fig. 62, or 63, *f*, which also sufficiently indicates the relations of these parts. The articulation of the jaw with the quadrate bone is furnished by a fifth piece called *articular* (*ar*) from its function. As a whole the mandible is a pronged bone, forking with a variable degree of divergence from its obtuse or acute point, sometimes quite parallel-sided, as in a duck, oftener very open; such prongs may be straight, or variously curved or bent either in the vertical or the horizontal plane; are generally stout and stanch, sometimes so slender as to be quite flexible. The articular part, always expanded horizontally, presents a smooth irregularly *cupped* superior surface for reception of the protuberances of the foot of quadrate. In general, the concave articular surface is divided into an inner and outer cup separated by a protuberance, corresponding to similar inequalities of the opposing surface of the quadrate. Cupping of the mandibular articulation is characteristic of birds as compared with mammals, in which latter the lower jaw has always a knobbed articular surface (condyle). In many birds the angle of the jaw is prolonged back of the articulation as a *posterior articular process* (fig. 63, *h*, 70, 71, *pap*), which may be long, slender and up-curved, as is well shown in a fowl, duck, or plover. Such birds are said to have the "angle of the mandible recurved;" the opposite condition is "angle truncated" (cut off). Usually also, an *internal angular process* (figs. 70, 71, *iap*) is produced inward from the articular part of the jaw, as in the fowl, duck. Between the dentary and articular parts, the ramus of the jaw is usually vertically produced as a thin raised crest, which, when prominent, is called the *coronoid process*; it corresponds to the strong process so called in a mammal, and relates to the advantageous

insertion of the temporal or masseteric muscles which effect closure of the jaw. It is scarcely evident in the fowl, fig. 62, but well marked in the duck, fig. 63, over *f*. At the back of the articular surface is the *pneumatic* foramen for entrance of air, when any; on the inner surface of the ramus, about the splenial bone, is the opening conveying the vessels and nerve.

The Hyoid Bone (Gr. letter ὑ, *hu*=hy, εἶδος, *eidos*, form; figs. 65–68, 72–74) is the skeleton of the tongue; a very composite structure, consisting of several distinct bones, developed in the second and third post-oral visceral arches (see fig. 65, where *ch* and *bh* are the original elements of the second arch, making the *basihyal* and *ceratohyal* bones, and *bbr*, *cbr*, and *ebr* are the original elements of the third arch, making the *basibranchial*, *cerato-branchial*, and *epibranchial* bones). The whole affair is somewhat Λ- or Π-shaped, lying loosely, point forward, between the forks of the lower jaw, with its long slender prongs curving up behind the hind head more or less; but not definitely connected with any other bones of the skull. The connection which exists between the hyoid and other cranial bones in a mammal is in birds broken by non-development of certain links of bone developed in the mammalian second post-oral arch, as the stylo-hyal, epihyal, etc.; though birds have a rudimentary stylohyal, at least in the embryo, among the several proximal parts of the second arch which form the intricate bones within the ear-passages (fig. 67). The visible parts of a bird's hyoid are usually: the body of the bone, *basihyal* (*bh*, and fig. 72, *c*), single and median, commonly quite short and stocky, sometimes long and slender. The basihyal bears in front a pair of *cerato-hyals* (*ch;* not shown in fig. 72, where they have been absorbed in *b*) usually movably articulated with the basihyal. They commonly appear as little "horns" or processes of the next piece, the *glosso-hyal* (fig. 72, *b*) or bone chiefly supporting the substance of the tongue. It may be a stout and apparently single bone, as that of the goose figured; but oftener appears as a pair of slender bones, side by side, whose backward ends are the cerato-hyals. The glossohyal may or may not bear at its fore end a cartilaginous tip, as in fig. 72, *a*. All the foregoing are hyal, i. e., belonging to the second visceral arch; the following are branchial, of the third arch: The *basi-branchial* (*bbr*, fig. 72, *d*) is a single median piece, projecting backward from the basihyal, with which it may be perfectly consolidated, as it is in the figure, or separately articulated; it may be wanting; it is usually tipped and prolonged backward with a thread of cartilage. The basibranchial is oftener called "urohyal," but had better be allowed its strict morphological name. On either side, the basihyal bears the separately articulated *cerato-branchials* (*cbr*, fig. 72, *e*), long slender bones diverging as they pass backward, and bearing upon their ends the *epi-branchials* (*ebr*, fig. 72, *f*), which finish off the hyoid bone behind, or may be in turn tipped with cartilaginous threads. The cerato- and epi-branchials together are badly called the "thyro-hyals," and in still more popular language the "greater cornua" or "horns" of the hyoid. All these bones vary in different birds in size and shape and relative development; the branchial elements are the most constant in their length and slenderness. The

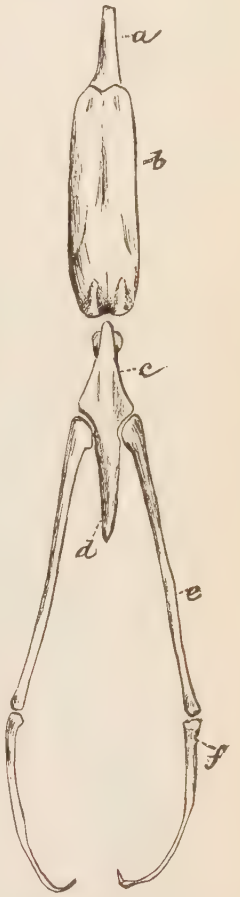
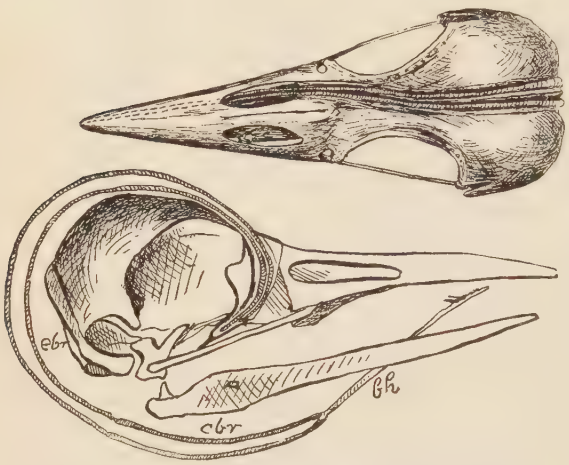


FIG. 72. — Hyoid bones of a goose, nat. size; by Dr. R. W. Shufeldt, U. S. A. *a*, cartilaginous end-piece of *b*, the great glosso-hyal, which has absorbed or replaced cerato-hyals or "lesser cornua"; *c*, basihyal, movably articulated with *b*, and combined completely with *d*, basibranchial, commonly called "urohyal;" *e*, ceratobranchial; *f*, epibranchial; *e* and *f* are together known as "thyro-hyals," or "greater cornua."

whole hyoid apparatus of the woodpeckers is specially modified; the basihyal is very long and slender, bearing stunted cerato- and glosso-hyals at its extreme end; there is no urohyal, or only a rudiment; the cerato-branchials are long, and the epibranchials so extraordinarily elongated in some species as to curl up over the back of the skull and forward along the top of the skull to a variable distance; sometimes, as in fig. 73, curling around the orbit of the eye, or, as in fig. 74, running into the nostril to the tip of the beak. In such cases they bundle together in passing forward over the skull, and go obliquely to one side. (Derivation of the terms in this paragraph: *hyal* is another form of *hyoid; branchial*, Lat. *branchiæ*, gills; *basi-*, Lat. *basis*, base; *cerato-*, Gr. κέρας, κέρατος, *keras, keratos*, horn; *epi-*, Gr. ἐπί, *epi*, upon; *stylo-*, Lat. *stylus*, a pen; *glosso-*, Gr. γλῶσσα, *glossa*, tongue; *uro-*, Gr. οὐρα, *oura*, tail; *thyro-*, Gr. θυρεός, *thureos*, a shield.)



FIGS. 73, 74. — Under fig. side view of a woodpecker's (*Picus*) skull, showing the long slender basihyal (*bh*), bearing slight elements at its fore end, no uroyhal, and extraordinarily long thyrohyals (*cbr, ebr*) curving up over back of skull and curling together around orbit of the right eye. Upper fig. top view of skull of *Colaptes*, showing thyrohyals running along the skull and into right nostril to end of the bill. (Dr. R. W. Shufeldt, U. S. A.)

Other Bones of the Skull. — The articulation of the lower jaw with the quadrate may have certain *sesamoids*. Thus, there are two such *sclerosteous* or ligament-bones in the external lateral ligament of the raven's jaw-joint, and the long occipital style of the cormorant and snake-bird is of the same character, being an ossification in the nuchal ligament of the neck. The siphon-like tube which conveys air from the outer ear-passage to the hollow of the mandible may ossify, as it does in an old raven, resulting in a neat tubular "air-bone" or *atmosteon* (Gr. ἄτμος, air).

Types of Palatal Structure. — The arrangement of the bones of the palate in birds results in several types of structure, first defined by Huxley and applied to the classification of birds. These are the *dromæognathous, schizognathous, desmognathous* and *ægithognathous*; to which Parker has added the *saurognathous*. Huxley proposed to make the primary division of Carinate birds upon this score; and since the plan could not be made to work in his hands, it is certainly futile for any one else to demonstrate again the impossibility of establishing the higher groups of birds upon any one set of characters, — upon the modifications of any one structure. Nevertheless, when duly co-ordinated with other characters, palatal structure becomes of the utmost importance in defining large groups of birds. It is necessary, therefore, for the student to clearly understand this matter, which I will lay before him as nearly as possible in the words of the authors just mentioned.

Dromæognathism (Gr. δρομαῖος, *dromaios*, a runner: genus-name of the *emeu*). — All the Ratite birds, and the tinamous alone of Carinate birds, are *dromæognathous*. "The posterior ends of the palatines and the anterior ends of the pterygoids are very imperfectly, or not at all, articulated with the basisphenoidal rostrum, being usually separated from it, and supported by the broad, cleft, hinder end of the vomer. Strong basipterygoid processes, arising from the

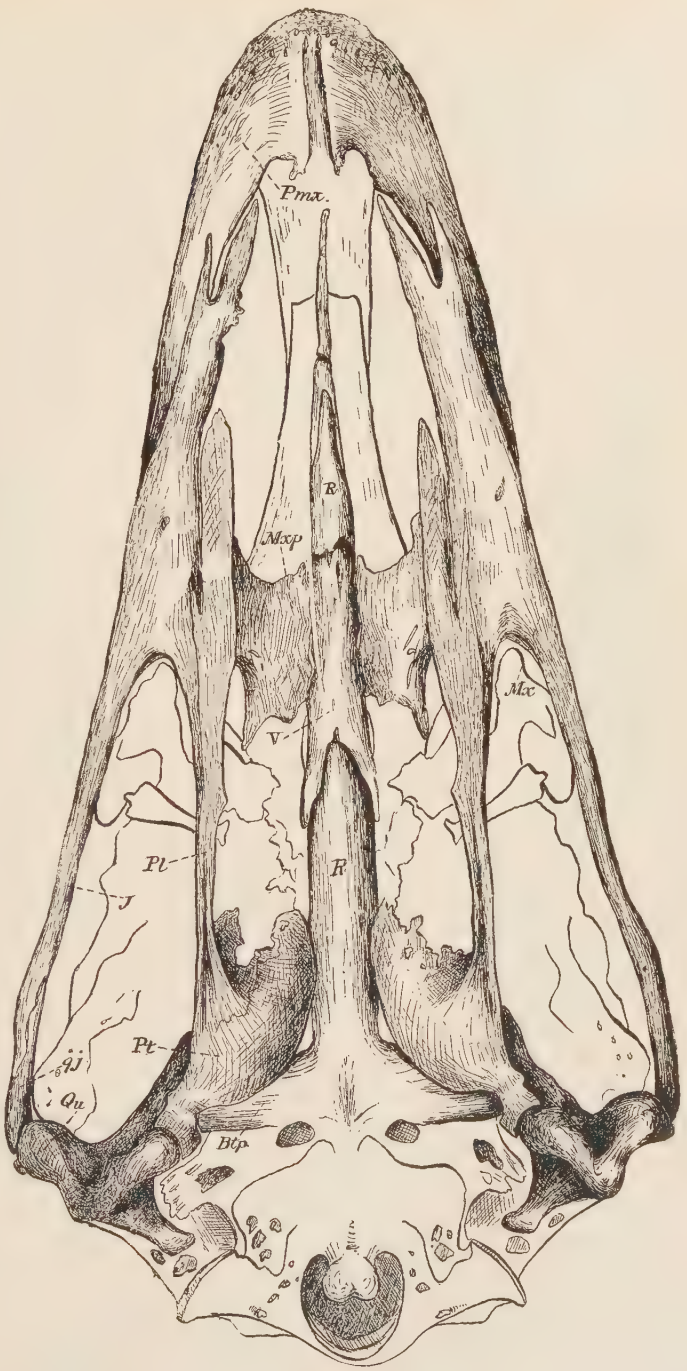


FIG. 75. — *Dromæognathous* skull of ostrich, 7-8 nat. size, from specimen No. 16,629, U. S. Nat. Museum, by Dr. R. W Shufeldt, U. S. A. *RR*, rostrum, beyond which the ossified nasal septum continues in the axis of the skull to the letters "*Pmx.*"; *V*, the short vomer, borne upon *R*, uniting laterally with *Mxp*, the broad maxillo-palatines; *Pl*, palatines, remote from rostrum, underrunning beyond *Mxp*, but not to *Pmx*. *Pt*, expanded scroll-like pterygoids, articulating *behind* with *Btp*, the strong basipterygoid processes on the body (not rostrum) of the sphenoid; they underlap *R*, but do *not* articulate there. *Pmx*, premaxillaries; *Mx*, maxillaries, whose ends run forward to opposite the letters "*Pmx*"; *j*, jugal; *qj*, quadrato-jugal; *Qu*, quadrate. (N. B. This is the most exceptional case of dromæognathism. Each one of the Ratite families, — *Struthionidæ, Rheidæ, Casuaridæ, Dinornithidæ*, and *Apterygidæ*, — as well as the Carinate family *Tinamidæ*, offers a special case of such formation, as explained in the text.)

body of the basisphenoid and not from the rostrum, articulate with facets which are situated nearer the posterior than the anterior ends of the inner edges of the pterygoid bones." This is

the gist of *dromæognathism;* it is exhibited in several ways. (*a*) In *Struthio* alone, fig. 75, the very short vomer, borne upon the rostrum, articulates neither with palatines nor with pterygoids, but with the maxillo-palatines; and the palatines, which are remote from the rostrum, advance beyond the maxillo-palatines, as in most birds. (*b*) In *Rhea*, the vomer is as long as usual in birds, and articulates behind with the palatines and pterygoids, but does not join the maxillo-palatines in front; the short palatines unite with the inner and posterior edges of the thin fenestrated maxillo-palatines. (*c*) In *Casuarius* and *Dromæus* (cassowary and emeu), the long vomer articulates behind with the palatines and pterygoids, and unites in front with the maxillo-palatines; these are flat, imperforate, and solidly joined to the premaxillæ; the palatines are short. (*d*) The extinct *Dinornis* had flat imperforate maxillo-palatine plates uniting solidly with the premaxillæ, and probably with the vomer, as in *Dromæus*. (*e*) In *Apteryx*, the long vomer unites with palatines and pterygoids behind; short broad palatines suture obliquely with flat imperforate maxillo-palatine plates, which unite both with premaxillary and vomer. (*f*) The tinamous, *Dromæognathæ* (fig. 76) "have a completely struthious palate"; vomer very broad, uniting in front with broad maxillo-palatine plates as in *Dromæus;* behind articulating with posterior ends of palatines and anterior ends of pterygoids, both of which are thus prevented, as in all *Ratitæ*, from any extensive connection with the rostrum; basipterygoid processes springing from body of sphenoid, not from its rostrum, articulating with pterygoids very near the posterior or outer ends of the latter; head of quadrate with a single articular facet, as in *Ratitæ*.

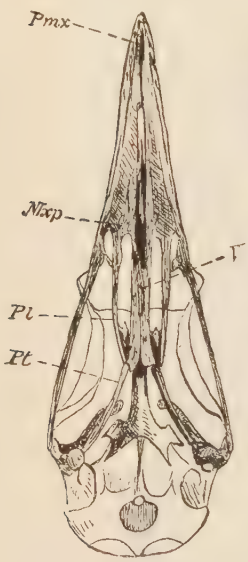


FIG. 76. — *Dromæognathous* skull of tinamou (*Tinamus robustus*); copied by Shufeldt from Huxley. Letters as before; *Mxp*, maxillo-palatine.

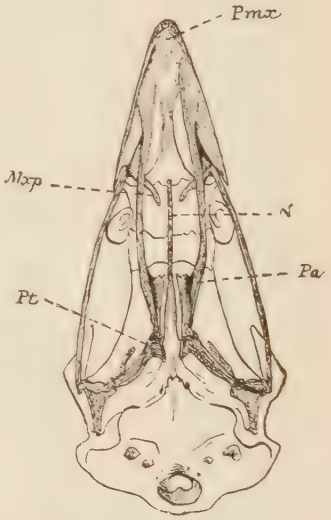


FIG. 77. — *Schizognathous* skull of common fowl, nat. size, from nature, by Dr. R. W. Shufeldt, U. S. A. Letters as before; *Pa*, palatine.

Schizognathism (Gr. σχίζω, *schizo*, I cleave) is the kind of "cleft palate" shown by the columbine and gallinaceous birds, by the waders at large, and many of the swimmers (see fig. 77). In this general case, the vomer, whether large or small, tapers to a point in front, while behind it embraces the basisphenoidal rostrum, between the palatines; these bones and the pterygoids are directly articulated with one another and with the basisphenoidal rostrum, not being borne upon the divergent posterior ends of the vomer; the maxillo-palatines, usually elongated and lamellar, pass inwards over [*under*, when the skull is viewed upside-down, as it usually is] the anterior part of the palatines, with which they unite and then bend backwards, along the inner edge of the palatines, leaving a broader or narrower fissure between themselves and the vomer, on each side, and do not unite with one another or with the vomer. It follows from this that in the dry skull of a plover, for instance, which shows the schizognathous arrangement extremely well, "the blade of a thin knife can be passed, without meeting with any bony obstacle, from the posterior nares alongside the vomer to the end of the beak." There are several groups of birds which exhibit the schizognathous plan, with ulterior modifications of palatal and other characters. (*a*) The colum-

bine birds (*Peristeromorphæ* of Huxley's arrangement): maxillo-palatines elongate and spongy; basipterygoid processes narrow, but prominent. (*b*) The gallinaceous birds (*Alectoromorphæ*): maxillo-palatines varying greatly in size, but always lamellar; palatines long and narrow, with rounded off postero-external angles; basipterygoid processes oval, flattened, sessile upon the rostrum, articulating with the pterygoids. (*c*) The penguins (*Sphenisco-morphæ*): maxillo-palatines concavo-convex and lamellar; no basipterygoid processes; pterygoids flattened. (*d*) In the gulls, petrels, loons, grebes, and auks, constituting the *Cecomorphæ* of Huxley, the maxillo-palatines are usually lamellar and concavo-convex, but may be spongy, tumid, and closely approximated to the vomer; and basipterygoid processes are absent or present. (*e*) In the cranes, rails, and their allies (*Geranomorphæ*), the maxillo-palatines are concavo-convex and lamellar, and basipterygoid processes are usually absent. (*f*). In the plover-snipe group, or limicoline *Grallæ* (*Charadriomorphæ*), the maxillo-palatines are always concavo-convex and lamellar; the basipterygoid processes narrow and prominent. Excepting perhaps group *d*, which does not hang together so well, the schizognathous groups here noted correspond very closely with recognized orders or suborders of birds; in all of them, the maxillo-palatines are perfectly distinct from one another and from the vomer, *and* the latter is slender and usually pointed. There are plenty of other birds in which the former factor in the case obtains; but in these the vomer is broad and usually truncate in front (see *Ægithognathism*, beyond).

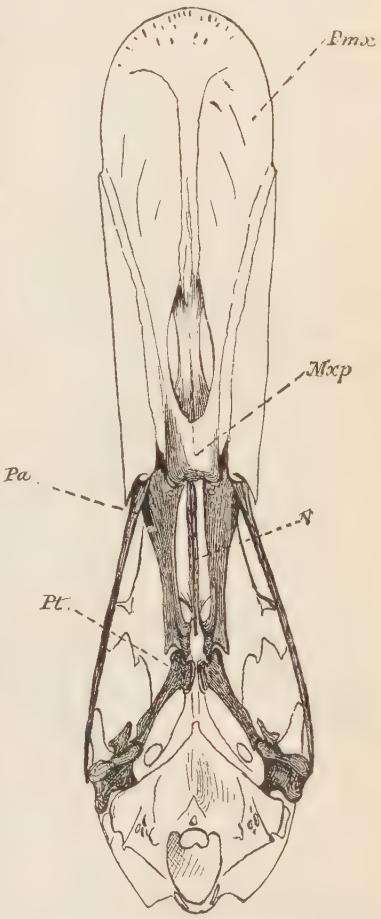


FIG. 78 — *Desmognathous* skull of mallard duck, *Anas boscas*, nat. size, from nature, by Dr. R. W. Shufeldt, U. S. A. Letters as before.

Desmognathism (Gr. δεσμός, *desmos*, a bond) is exhibited in one or another style by those swimming and wading birds which are not schizognathous, by the birds of prey, and various non-passerine perching birds. It does not fadge so well as any other one of the palatal types of structure with recognized groups of birds based on other considerations. In the "bound-palate" type, the vomer is either abortive, or so small that it disappears; when existing it is usually slender and tapers to a point in front; the maxillo-palatines are united across the median line, either directly or by means of ossifications in the nasal septum; the posterior ends of the palatines and the anterior ends of the pterygoids articulate directly with the rostrum (as in schizognathism). This type is simply and perfectly exhibited by a duck (fig. 78) in which the maxillo-palatine is a broad flat plate united with its fellow in mid-line; the oval sessile basipterygoid facets are far forward, opposite the very ends of the pterygoids. In the flamingo, ibis, spoon-bill, stork, heron, the united maxillo-palatines are tumid and spongy, filling the base of the beak; basipterygoids are wanting (rudimentary in the flamingo). In totipalmate swimmers (pelican, cormorant), desmognathism is carried to an extreme by union of the palate bones also across the mid-line; the general arrangement is as before. The birds of prey exhibit several special conditions of desmognathism. The parrots are another case; among

other cranial characters of these birds is to be noted the *articulation* of the palate bones with the upper beak, like that of the zygoma. The multifarious Picarian birds, or non-passerine Insessores, are desmognathous, excepting the schizognathous trogons (*Trogonidæ*) and the "saurognathous" woodpeckers. Parker has established the following categories of desmognathism: (*a*) *Perfect direct*, the maxillo-palatines uniting below at the mid-line; either with the nasal septum free from such bony bridge, as in a duck; or anchylosed therewith, as in many birds of prey. (*b*) *Perfect indirect*, very common, as in eagles, vultures, owls; maxillo-palatines separated from each other by a chink, but anchylosed with nasal septum. (*c*) *Imperfectly direct;* maxillo-palatines sutured together, but not anchylosed. "In young falcons and hawks the palate is at first indirect, is then imperfectly direct, and at last perfectly direct." (*d*) *Imperfectly indirect;* maxillo-palatines closely articulated with, and separated by, the "median septo-maxillary;" but there is no anchylosis. (*e*) *Double:* the palatines united as well as the maxillo-palatines; as in the pelican and cormorant above noted, in certain Caprimulgine birds, horn-bills, etc. (*f*) *Compound:* when the properly *ægithognathous* skull of a passerine bird becomes also desmognathous.

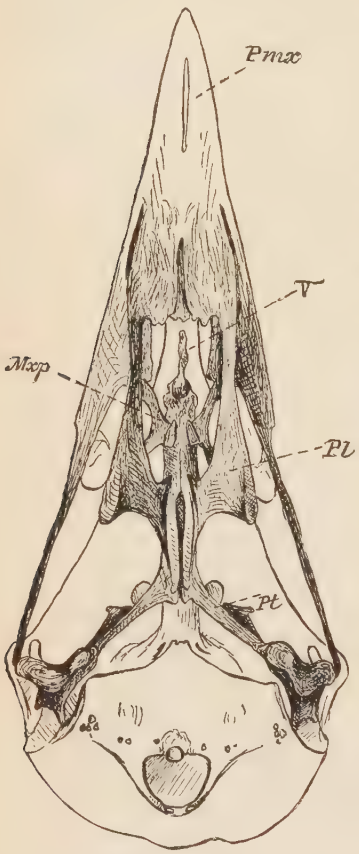


FIG. 79. — *Ægithognathous* skull of raven, *Corvus corax*, nat. size, from nature, by Dr. R. W. Shufeldt, U. S. A. Letters as before. N. B. The reference line, *V*, goes to the ossified nasal septum borne upon the end of the vomer, which latter bone begins at the thickest part of the central projection. *Mxp* underlies *V* and overlies *Pl*, but touches neither.

Ægithognathism (Gr. *αἰγιθαλός*, *aigithalos*, some small bird) is exhibited almost unexceptionally by the great group of Passerine birds; it is also nearly coincident with *Passeres*, though a few other birds, notably the swifts (*Cypselidæ*), also exhibit it. Huxley's term *Coracomorphæ*, nearly synonymous with *Passeres*, relates to the palatal structure exhibited by a raven (fig. 79), as typical of that of *Passeres* at large. The vomer is a broad bone, truncate in front and deeply cleft behind, embracing the sphenoidal rostrum in its forks. The palatines have produced postero-external angles. The maxillo-palatines are slender at their origin, extending inwards and backwards over the palatines and under the vomer, where they end free, being united neither with each other nor with the vomer. This disconnection of the maxillo-palatines is *quoad hoc* "schizognathous," of course; but such condition, in *association with* the peculiarities of the vomer, is ægithognathous. The nasal septum in front of the vomer is often ossified in ægithognathism, and the interval between it and the premaxillæ filled up with spongy bone; but no union takes place between this ossification and the vomer (Huxley). According to Parker, the distinguishing character of the ægithognathous type is the union of the vomer with the alinasal wall and turbinals. He distinguishes four styles: (*a*) *Incomplete;* very curiously exhibited by the low *Turnix*, which stands near the gallinaceous birds. (*b*, *c*) *Complete*, as represented under two varieties, one typified by the crow, an Oscine Passerine, the other by the Clamatorial Passerines *Pachyrhamphus* and *Pipra*. (*d*) *Compound*, i. e., mixed with a kind of desmognathism, as noted above. "Vomer truncated in front" is the general expression for the condition of that bone in the

ægithognathous type; it is frequently massive in that direction, and of endlessly varied configuration.

Saurognathism. — (Gr. σαῦρος, *sauros*, a lizard; fig. 80). According to Huxley the woodpeckers exhibit a "degradation and simplification of the ægithognathous structure." The peculiarities of the palate of these birds (including *Picidæ*, *Picumnidæ* and *Iyngidæ*) are so decided that Parker proposes to call them *saurognathous*. The structure is very difficult to make out, and may be understood best by study of the accompanying figure, copied from Parker. The maxillo-palatines, *mxp*, are very slight, not extending inward beyond the outer margin of the palatines, and being sometimes quite rudimentary. In front of them, an additional little palatal plate of the maxillary, *pmx*, is developed. The vomers, *v*, are delicate paired rods on each *side* of the median line. The postero-external angle of the palatine is either rounded off or obtuse-angled. Where the broad main part of the palatine suddenly narrows is developed an interpalatine process, *ipa*. The ethmo-palatine plates, *epa*, or internal superior plates of the palatine, which are of variable length, are connected by the most marked *medio-palatine* ossification, *mpa*, seen in the class of birds. Bridges of bone are deposited along the inner borders of the palatines; such are the septo-maxillaries, *smx*, and other formations which, like the medio-palatine, serve to bind the palate halves together. The nasal chambers are unusually simple; there are peculiarities of the tympanic cavity and quadrate bone.

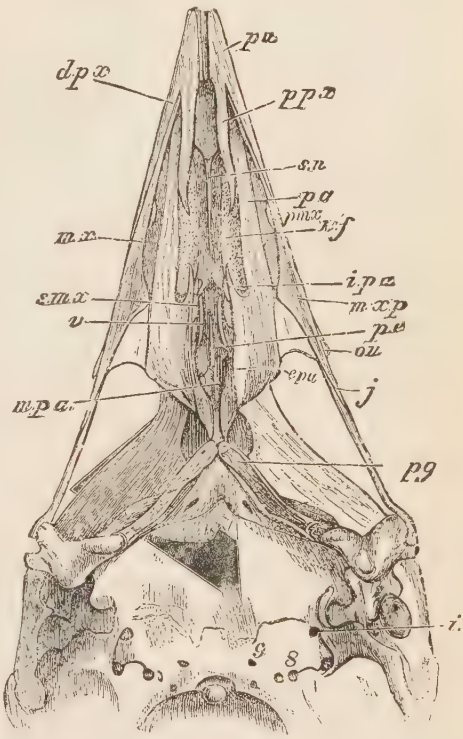


FIG. 80. — *Saurognathous* skull of nestling *Picus minor*, × 4 diameters, after Parker. *Px*, premaxillary: *dpx*, its dentary process; *ppx*, its palatal process; *sn*, septo-nasal; *pa*, palatine; *pmx*, peculiar palatal plate of maxillary of a woodpecker; *nf*, nasal turbinal; *mx*, maxillary; *ipa*, interpalatal spur of palatine bone; *mxp*, rudimentary maxillo-palatine, scarcely reaching palatine; *smx*, septo-maxillary, in several pieces: *v*, right vomer, its fellow opposite; *pe*, lower border of perpendicular plate of ethmoid, between vomers; *epa*, ethmoidal (inner) plate of palatine; *mpa*, medio-palatine; *pg*, pterygoid; *i*, foramen for internal carotid; 8, for vagus nerve; 9, for hypo-glossal nerve.

"All these things being considered," says Parker, in conclusion, "it will seem contradictory now to assert the great uniformity of the skulls of Birds, and indeed of Birds themselves. Yet so it is; and the countless modifications that offer themselves for observation are gentle in the extreme. One form is often seen to pass into another by almost insensible gradations. . . . In the rest of the Birds' organization abundant evidence of the same specialization will be seen. The mind fails to desire more beauty or to contemplate more exquisite adaptations. An almost infinite variety of Vertebrate life is to be found in this class. Of its members some dig and bury their germs, which rise again in full plumage, whilst others watch and incessantly feed their tender brood in the shady covert or 'on the crags of the rock and the strong place.' In locomotion some walk, others run, or they may wade, swim, plunge, or dive, whilst most of them 'fly in the open firmament of heaven.'" (*Ency. Brit.* 9th ed. Art. Birds, p. 717.)

b. Neurology; The Nervous System; Organs of Special Senses.

The Nervous System of any Vertebrate determines the form of such an animal; in fact, the beautiful skeleton we have examined is simply a sketch in bone of the *cerebro-spinal nervous system*, conformably with which the whole bony framework of the body is erected. A brain and spinal chord and their lateral prolongations or nerves are the commanding superadditions, in a vertebrate, to any such nervous system as an invertebrate may or does possess. Besides the vertebrate or main nervous system, all brainy vertebrates retain a *sympathetic system* of nerves, supposed to represent a modified inheritance of the whole nervous system of Invertebrates. Thus the cerebro-spinal and sympathetic are the two distinct nervous systems of nearly all vertebrates, — of all vertebrates which have a skull and brain. The former presides over the *animal* life of the creature, — its sensations, perceptions, and voluntary actions; the latter more especially over its *vegetative* functions, as digestion, respiration, circulation, and reproduction, which are more or less involuntary. But the two are inseparably connected, anatomically and physiologically, so that no distinct line can be drawn between them. Nerve-tissue consists of an aggregation of nerve-cells and their investing substance, — the bodies of a myriad *Neuramœbæ* agglutinated by their secretions. They are of two species: *Neuramœba cinerea* and *N. candida*. The former are usually multiradiate, inosculating cells of nerve-substance, which form the "gray matter" of the brain and spinal chord and the *ganglia* (knots) of nerves; the latter are white, thready, and form the connections of the ganglionic masses and the whole substance of ordinary nerve-chords. The gray amœbas are the immediate communicants between the mind and the body of the creature; the white amœbas are the mediators between the body and outward things. The gray amœbas translate thought in terms of matter, and conversely; the white convey the translation. How this is done, no one knows, but the fact is manifest. In ordinary language, gray nerve centres receive from white tracts impressions made upon the periphery of the nervous system; and, with or without the knowledge and consent of the animal, convert these impressions into appropriately responsive actions. This is called the "reflex action" of the nervous system. Some think such reflection is the principal or only activity of the nerve-tissue, taking animals to be mere automata, the mechanism of which is only set in motion by external stimulation. Others think that animals, and even human beings, have in their *consciousness* an inner spring of action, vaguely called "spiritual," whose operations upon the matter of their bodies manifests what is called by some "mind," by others "soul." I am satisfied of the correctness, in the main, of the latter view; but, however this may be, it is quite certain that white nerve tissue is a means of carrying something to and fro, which something is called a "nerve impulse," for want of knowing what it is. White nerves have therefore an *efferent* function, when they carry impulses outward from gray centres, and an *afferent* function, when they bring impulses in to gray centres. The former is their *motor* function; the latter is their *sensory* function. In nerves at large, impulses of both kinds travel in the same tracts without interference; such mixed nerves are therefore called *sensori-motor*. Thus, each spinal nerve has a posterior sensory ganglionated root, and an anterior motor simple root, which soon blend in one chord, in which both functions coexist. Some nerves seem to be entirely motor, as those which move muscles of the face and tongue. The purest sensory nerves are those of "special sense," as the olfactory, optic, and auditory. Some nerves are so "mixed" as to combine functions of special sense, common sensation, and motion, as that called glosso-pharyngeal, which moves, feels, and tastes. The motor effluence of nerve tissue upon itself and other parts of the body is literally *animation;* the sensory influence is nominally *materialization*. The physical mechanism of these occult processes in a bird is as follows: —

The Brain (Lat. *cerebrum;* Gr. ἐγκέφαλον, *egkephalon;* frontisp.) is the anterior dilatation and complication of the main nervous axis of the body, contained within the skull. It resembles a soap-bubble blown at the end of a pipe, being not less beautiful in its iris-quality, and not less lasting. It is primarily triune, or three-fold, beginning as three such bubbles, called the *anterior, middle,* and *posterior cerebral vesicles,* corresponding to what are afterward the fore-brain, mid-brain, and hind-brain, or *prosencephalon, mesencephalon,* and *opisthencephalon.* The birth and multiplication of gray neuramœbas causes thickenings of the bladdery membranes in various places and ways; all such gray deposits are the *ganglia* of the brain, and the great peripheral ganglion is the *cortical* layer or "bark of the brain." Similar deposits of white neuramœbas connect all these ganglionic colonies, furnishing the various *commissures* of the brain. The cavity of the original bubbles, continuous with the hollow of the pipe-stem or spinal chord (which was at the outset a furrow along the back of the embryo, not a tube) becomes partially divided up into several communicating hollows; these are the *ventricles* (little bellies) of the brain. Actual prolongations of brain-tissue, or nervous threads more like the ordinary spinal nerves, pass out of the brain-box; these are *cerebral nerves,* oftener called *cranial nerves;* there are twelve pairs of them. At the pituitary space (see p. 151; the noto-chord ends just behind it; fig. 64) is developed a remarkable structure, the *pituitary body:* its nature is unknown. This lies under the brain; opposite it, on top of the brain, is another curiosity, the *pineal body;* it has been considered the special seat of the soul by some, though others have located that throne of animal grace in the solar plexus of the sympathetic system, which is in the belly. The pituitary and pineal are also called respectively the *hypapophysis* and *epapophysis cerebri.* They lie respectively at the bottom and top of one of the cavities of the brain, arbitrarily called the *third ventricle;* the anterior wall of this ventricle is the *lamina terminalis,* or terminal sheet of the brain, with which, morphologically speaking, the brain ends in front; though, in its actual growth, the prosencephalon crowds ahead of this formation. As the brain-cells multiply, the prosencephalon outgrows the associated parts, and becomes nearly separated into lateral halves; these are the *hemispheres of the cerebrum,* or "halves of the great brain"; they retain their ventricles, which intercommunicate through a passage-way, which also leads into the third ventricle; this is the *foramen of Munro.* Each sends out in front a hollow process; these processes are the *olfactory lobes,* or *rhinencephalon* ("nose-brain"). A great ganglionic thickening of gray matter in the interior of each hemisphere is the *corpus striatum;* these "striped bodies" are connected by the *anterior commissure* of the brain. The rest and greater part of the original anterior cerebral vesicle makes up by ganglionic thickening of its sides into what are called misleadingly the *optic thalami,* since these tracts have nothing to do with the sense of sight. The thalami and associate parts behind the lamina terminalis (third ventricle, etc.) compose what is called the *thalamencephalon,* or "bed-brain." The original middle cerebral vesicle makes up underneath into longitudinal commissural fibres, called the *crura cerebri* or "legs of the brain," connecting fore and aft parts; but especially composes the ganglionic centres called *corpora bigemina,* or "twin bodies." These are the *optic lobes,* or "eye-brain." They are connected by transverse commissure. The optic ganglia and commissure, the cerebral crura, and contained cavities, essentially compose the *mesencephalon* or "mid-brain." The original posterior cerebral vesicle (opisthencephalon) becomes separated into two parts: The fore part of it is moulded into the considerable mass of the *cerebellum* ("little brain"); which, with its connections of white substance (pons varolii, peduncles, etc.) and the hollow underneath it ("fourth ventricle") constitutes the *metencephalon* or "after-brain." The hind part of it tapers off into the spinal chord; this tapering part is the *medulla oblongata,* or "oblong marrow," also called the *myelencephalon,* or "marrow-brain." This description is pertinent to brains at large, representing the general plan of structure; any fairly developed encephalon shows the parts specified; and most complicated brain, as that of man, only shows what elaborate finishing touches

may be given to the simple structure thus outlined, when cells, both white and gray, but especially the latter, are profusely furnished, to the ornamentation of the mind's estate with race-tracks great and small, and the place of fornication, — fruits of the olive, and of the arbor vitæ. The membranes, or *meninges*, which hide all this from the uninitiated, are three. The *pia mater*, or "tender mother," which immediately invests the brain, is very vascular, and furnishes the blood supply; not only by small arteries which immediately penetrate the substance of the brain, but by enfolded sheets which enter the ventricles, and are called *choroid plexus*. The *arachnoid*, or "cobweb," comes next; a serous fluid which it secretes bathes the brain, and meets concussion with its gentler fluctuation. The *dura mater*, or "stern mother," is a dense outer membrane which enwraps and holds the whole firmly. These meninges descend into the spinal column, and answer the same purpose there, maintaining the same disposition around the spinal chord.

The Bird's Brain offers the following comparative characters: It is compact, having nothing of the straggling apart of its elements seen in low vertebrates, and completely fills the cranial cavity. Its long axis is about transverse to the axis of the spinal column. The cerebral hemispheres are well developed, but do not cover the cerebellum or optic lobes; from their dome the rhinencephalon protrudes like a porte-cochère. Their surface is quite smooth (devoid of the gyri and sulci of most mammalian brains); even the sylvian fissure is barely indicated. The optic lobes are of immense size, relatively to those of most vertebrates, and relatively to the rest of the encephalon; they appear much loosened from their surroundings, at the *sides* and *lower part* of the mid-brain; they retain their ventricles, as does also the rhinencephalon. The corpora striata are very large. The *fornix* is rudimentary. The cerebellum is well developed and deeply sulcate, with transverse fissures, but is not divided into right and left lobes; a "fleecy" lobule on each side, the *flocculus*, is well defined, and received in a special recess of the inner wall of the skull. Parts of the medulla oblongata notable in mammals are obscure or obsolete. There is no *pons varolii*, or superficial transverse commissure of the cerebellum, nor any *corpus callosum*, — that great white commissure of the cerebral hemispheres, characteristic of all but the lowest mammals.

The Spinal Chord, or *medulla spinalis* ("spinal marrow") is the main nerve-axis of the body, running in the series of neural arches of the vertebræ from head to tail; it directly continues the medulla oblongata. It retains its primitively tubular character in part at least, and consists as usual of white matter enclosing gray matter. The chord is fissured into lateral columns, as these are also to some extent into anterior and posterior tracts. The latter diverge in ascending the medulla oblongata, to throw the central tube into the cavity of the fourth ventricle; and especially in the sacral region, where a sort of ventricle, known as the avian *sinus rhomboidalis*, is similarly formed. The calibre of the chord increases at the root of the neck, where large nerves are to be given off from the brachial plexus to the wings, and again in the sacral region, with the same reference to nerve supply of the legs; after which the chord continues to the end of the spinal canal as a terminal thread.

The Cranial Nerves are twelve pairs, as in mammals, the highest vertebrate number. **1,** the *olfactory* nerve of special sense (smell); origin from rhinencephalon; exit from cranial cavity by olfactory foramen, high up in orbital cavity; conducted along a groove to final escape between perpendicular and lateral plates of ethmoid into the nasal chambers; distributed to the investing mucous membrane of the septal and turbinal bones of the nose. The exit is through a sieve-like or *cribriform* plate only in *Apteryx* and *Dinornis* (Owen). **2**, the *optic*, nerve of special sense (sight); origin from optic lobe and thalamus; of great size, and form of *chiasm* (decussation) with its fellow; exit by optic foramen, a large hole in back of

cavity between centres of orbito-sphenoid and alisphenoid, close to or in common with its fellow. This nerve forms the retina of the eye. **3**, **4**, **6**, the *oculi-motor, pathetic, abducent*, collectively the motor nerves of the eye, supplying the muscles moving the eye-ball; **3**, to all these muscles excepting superior oblique and external rectus; origin from crura cerebri, base of mesencephalon; **4**, to the superior oblique, origin behind optic lobes, upper surface of metencephalon; **6**, to external rectus (also to muscles of the third eyelid in birds); origin between met- and myel-encephalon, base of brain; **3**, **4**, **6**, exits from cranial into orbital cavity by several small, not constant, foramina near optic foramen; or by this foramen sometimes all the nerves which enter the orbit pass out of brain cavity through one great hole. **5**, great *trifacial* or *trigeminal*, sensori-motor; feeling skin of head, moving muscles of jaws; origin (double) from myelencephalon; leaves brain from sides of metencephalon; sensory root has gasserian ganglion; motor root simple. This nerve has three divisions, whence its name: **5***a*, *ophthalmic* division, the most distinct; exit from cranial into orbital cavity by separate foramen above and to outer side of optic foramen; grooves orbital wall in passing; *ciliary* ganglion; distribution mainly to lacrymal and nasal parts; traceable to end of upper mandible; **5***b*, *superior maxillary;* exit by foramen ovale, in alisphenoid or between that and proötic centre; distribution to side of upper jaw; *meckelian* ganglion; **5***c*, inferior maxillary, derived chiefly from motor root; exit same as **5***b;* distribution to lower jaw (muscles, substance of bone, integument); no *special sense* (gustatory) function; no *otic* ganglion. **7**, *facial* or *portio dura*, motor; origin from myelencephalon; enters periotic bone, escapes from ear behind quadrate bone, by what corresponds to stylo-mastoid foramen of mammals; communicates with **5***c* by *chorda tympani* nerve, with **9**, **10**, **12**, and sympathetic system; distribution to skin-muscles and others of lower jaw and tongue, etc. **8**, *auditory* or *portio mollis*, nerve of special sense (hearing); origin with **7**; no exit from skull; enters meatus auditorius internus of periotic bone; forms auditory apparatus in labyrinth of ear. **9**, *glosso-pharyngeal*, mixed nerve, sensori-motor and gustatory (taste); origin myelencephalon; exit by foramen in exoccipital bone, behind basitemporal, near lower border of tympanic recess; distribution to muscles and membranes of gullet, throat, tongue, etc. **10**, *pneumogastric*, sensori-motor; origin and exit next to **9**; distribution to windpipe, lungs, gullet, stomach, heart, etc.; has recurrent syringeal to vocal organs. **11**, *spinal accessory*, sensori-motor; origin upper part of spinal chord; exit with **9**, **10**; distribution to these nerves and to muscles of neck. **9**, **10**, **11**, are intimately connected with one another, and with other nerves, especially **10** with sympathetic. The several foramina in a bird's skull which may be seen in the place indicated at 8, figs. 69, 70, are for the divisions of this composite *vagus* or "wandering" nerve of respiration, circulation, digestion, etc.; they represent morphologically a *foramen lacerum posterius*, between exoccipital and opisthotic centres. **12**, *hypoglossal*, motor nerve of the tongue; origin from myelencephalon; exit by anterior condyloid foramen in front of the occipital condyle. Thus the plan of the cranial nerves of birds is nearly coincident with that of mammals.

The Spinal Nerves, in pairs, correspond in a general way to the vertebræ, between which they pass out by *intervertebral foramina*, to supply the body at large. They are sensori-motor; arise from the spinal chord by anterior motor and posterior sensory (ganglionated) roots which unite before leaving the spinal canal; in the sacral region the main branches leave by separate foramina. They form *plexuses* or interlacements. The principal of these is the *brachial plexus;* constituted by several lower cervical nerves, and one or two usually counted as dorsal, which combine to form a single chord, whence the nerves of the wing are derived. Similar network of three to five true sacral nerves furnishes the nerves of the leg.

senting **Sympathetic System** consists of a pair of nervous chords running lengthwise below fied; es of the vertebræ, one on each side in the trunk, and in corresponding relations with

cranial bones. An extensive and intricate series of communications is effected with the nerves of the cerebro-spinal system, excepting the special-sense nerves of smell, sight, and hearing. The points of communication form a chain of sympathetic ganglia; from these knots, the most conspicuous features of the system, nervous chords pass to their distribution in the motory mechanism of the heart and blood-vessels and other viscera. The anterior sympathetic nerves are the *iridian;* the ganglia are the *spheno-palatine* or *meckelian*, intimately connected with cranial nerves. The system ends behind in the caudal region of the spine by a *ganglion impar*.

Sense of Smell: Olfaction. — The sense of smell is effected by terminal branches of the olfactory (1st cranial) nerve, ramifying in the mucous (pituitary or schneiderian) membrane of the nasal cavities. Owing to the comparatively small size and little complexity of the foldings and pleatings of bone or cartilage in the nasal chambers, the sensory surface being correspondingly limited, it is not probable that birds possess this sense in a high degree. Besides the cartilaginous or osseous *septum*, generally more or less complete in birds, there are lateral scrolls and whorls of bone in endless diversity in most birds, which may be ossified, or remain gristly. The general cavity is mostly bounded and enclosed by the bony beak; floored by the anterior part of the hard palate; defended on each side by the descending prong of the nasal bone; in the dry skull, it either seems continuous with the great orbital cavity on each side behind, or is separated therefrom by lateral ethmoid (pre-frontal) or lacrymal ossifications, or both. Outwardly the nasal chambers open upon the beak by the external nostrils — orifices of great zoölogical diversity, as already indicated (p. 104), bounded by prongs of the premaxillary and nasal bones. These openings are minute or quite obliterated in some *Steganopodes*, as pelicans and cormorants. The nasal cavities always communicate with the back part of the mouth, or the *posterior nares* (Lat. *naris*, a nostril); generally paired, that is, with a partition between them, sometimes united in one median aperture. The olfactory nerve, which is rather a prolongation of the rhinencephalon itself than an ordinary nerve, escaping from the brain-box by a special foramen, traversing the upper part of the interorbital septum in a groove or canal, enters the nasal cavity by a single orifice (excepting *Apteryx* and *Dinornis*), instead of the numerous apertures in a cribriform plate by which its filaments reach their destination in mammals. The true sensitive membrane in which the nervous filaments end is that investing *ethmoidal* (septal and turbinal), not maxillary parts. An associate structure of the olfactory organ is the *nasal gland*, sometimes called the *superorbital* gland, from its position in many birds. Thus it is of great size in a loon, and lodged in large deep crescentic depressions on top of the skull over the orbits (fig. 63, *w*); these crescents nearly meeting each other in the middle line. In other birds it is smaller, and within the cavity of the orbit, but never in that of the nose itself, its secretion being poured into the nasal chamber by a special duct.

Sense of Sight: Vision. — The eye is an exquisitely perfect optical instrument, like an automatic camera obscura which adjusts its own focus, photographs a picture upon its sensitized retinal plate, and telegraphs the molecular movements of the nervous sheet to the optic "twins" of the brain, where the result is "biogenized;" that is, translated from the physical terms of motion in matter to the mental terms of consciousness. But no part of the nervous tract, from the surface of the retina to the optic centre, sees or knows anything about it, being simply the apparatus through which the Bird looks, sees, and knows. In this class of Vertebrates, the optic organs, both cerebral and ocular, are of great size, power, and effect; their vision far transcends that of man, unaided by artificial instruments, in scope and delicacy. The faculty of *accommodation*, that is, of adjusting the focus of vision, is developed to a marvellous degree; rapid, almost instantaneous, changes of the visual angle being required for distinct perception of objects that must rush into the focal field with the velocity at least of the bird's flight.

Birds are therefore far-sighted or near-sighted (presbyopic or myopic) according to the degree of *tension* the nerve-tide excites in the eye by the mechanism described further on; and the transition from one to the other state is effected with great quickness and correctness. Observe an eagle soaring aloft until he seems to us but a speck in the blue expanse. He is far-sighted; and scanning the earth below, descries an object much smaller than himself, which would be invisible to us at that distance. He prepares to pounce upon his quarry; in the moment required for the deadly plunge he becomes near-sighted, seizes his victim with unerring aim, and sees well how to complete the bloody work begun. A humming-bird darts so quickly that our eyes cannot follow him, yet instantaneously settles as light as a feather upon a tiny twig. How far off it was when first perceived we do not know; but in the intervening fraction of a second the twig has rushed into the focus of distinct vision, from many yards away. A woodcock tears through the thickest cover as if it were clear space, avoiding every obstacle. The only things to the accurate perception of which birds' eyes appear not to have accommodated themselves are telegraph-wires and light-houses; thousands of birds are annually hurled against these objects to their destruction.

The *orbital cavity*, *orbit*, or socket of the eye, has been almost sufficiently described (p. 150; see also any figs. of skull in profile) as that great recess in the side of the skull bounded above by the roofing frontal bone, behind by this and sphenoidal elements, in front, if at all, by lateral ethmoidal elements (pre-frontal), and separated from its fellow more or less completely by the inter-orbital septum, which is chiefly the perpendicular plate of the mesethmoid, but may be also in part orbito-sphenoidal and pre-sphenoidal. The brim is completed in few birds, by union of lacrymal and post-frontal; in quite a number of birds, however, it is nearly perfected by the approximation of these same bones, as in fig. 63, *u* and *m*, and in some the rim is carried out by extra supra-orbital and infra-orbital ossification. There is no bony floor, or only such slight scaffolding as the expansion of the palatine and pterygoid may afford. The zygoma itself, in many dry skulls, seems like the threshold of the orbital chamber. The bony walls may be also defective in some places by great vacuities in the inter-orbital septum (fig. 70, *iof*, and fig. 63, *z*), and others in the cerebral wall, aside from the regular foramina which the nerves pass through. The 1st — 6th nerves (p. 176) inclusive usually enter the orbit: of their foramina, the *optic* (figs. 66, 68, 70, 71, ^{2}, and fig. 63, *y*) is much the largest and most constant, generally blended with its fellow. Those for nerves 1 and 5 (p. 177) are next most obvious and constant; others are often, and all may be, thrown into one large opening. In such a socket as this the eye-ball rests upon a cushion of muscle, fat, gland, and connective tissue; and large as is the chamber, the ball fits and nearly fills it. A bird's eye-ball is *much* larger than the opening of the eye-lids (see p. 30, note).

As to its development: "the *Eye*" says Huxley "is formed by the coalescence of two sets of structures, one furnished by an involution of the integument, the other by an outgrowth of the brain. The opening of the tegumentary depression, which is primarily [in the very early embryo] formed on each side of the head in the ocular region becomes closed, and a shut sac is the result. The outer wall of this sac becomes the transparent *cornea* of the eye; the epidermis of its floor thickens, and is metamorphosed into the *crystalline lens;* the cavity fills with the *aqueous humor*. A vascular and muscular ingrowth taking place round the circumference of the sac, and dividing its cavity into two segments, gives rise to the *iris*. The integument around the cornea, growing out into a fold above and below, results in the formation of the eyelids, and the segregation of the integument which they enclose, as the soft and vascular *conjunctiva*. The pouch of the conjunctiva very generally communicates, by the *lacrymal duct*, with the cavity of the nose. It may be raised, on its inner side, into a broad fold, the *nictitating membrane*, moved by a proper muscle or muscles. Special glands — the *lacrymal* externally, and the *harderian* on the inner side of the eye-ball — may be developed in connection with, and pour their secretion on to, the conjunctival mucous membrane. The posterior chamber of the

eye has a totally distinct origin. Very early that part of the anterior cerebral vesicle which eventually becomes the vesicle of the third ventricle, throws out a diverticulum, broad at its outer, narrow at its inner end, which applies itself to the base of the tegumentary sac. The posterior, or outer, wall of the diverticulum then becomes, as it were, thrust in, and forced towards the opposite wall by an ingrowth of the adjacent connective tissue; so that the primitive cavity of the diverticulum, which, of course, communicates freely with that of the anterior cerebral vesicle, is obliterated. The broad end of the diverticulum acquiring a spheroidal shape, while its pedicle narrows and elongates, the latter becomes the optic nerve, while the former, surrounding itself with a strong fibrous *sclerotic* coat, remains as the posterior chamber of the eye. The double envelope, resulting from the folding of the wall of the cerebral optic vesicle upon itself, gives rise to the *retina* and the *choroid* coat, the plug or ingrowth of connective tissue gelatinizes and passes into the *vitreous humor*, the cleft by which it entered becoming obliterated." (Anat. Vert., 1871, p. 79.)

Birds alone, of all animate beings, may be truly said to "fall asleep" in death. When the "silver cord" of a bird's life is loosed, the "windows of the soul" are gently closed by unseen hands, that the mysterious rites of divorce of spirit from matter may not be profaned. When man or any mammal expires, the eyes remain wide open and their stony stare is the sign of dissolution. Only birds close their eyes in dying. At the same moment, the eye sinks and seems to collapse, by the ebbing of its waters. The closure is chiefly effected by the uprising of the lower lid. These are the principal external differences between the eyes of birds and mammals. The movements of the upper lid in most birds are much more restricted than those of the lower. The few exceptions are chiefly furnished by night birds, as owls, whippoorwills, and others of their respective tribes. The lids consist externally of common skin, internally of a layer of *conjunctival* (joining) mucous membrane, with interposed connective tissue: the lower is also stiffened with a smooth plate, the *tarsal cartilage*. The upper is raised by a small muscle, called from its office *levator palpebræ superioris*, arising from the bony orbit. There is no special lowering nor lifting muscle of the under lid; the lids close together by the action of the *orbicularis oculi*, which nearly surrounds the eye, and whose chief office is to lift the lower lid; the latter has a small distinct *depressor* muscle. Birds have no true hairs, but in some kinds modified filiform feathers answer to eye-lashes. When wide open the orifice of the lids is circular, that is, without the inner and outer corners (*canthi*) of almond-eyed creatures like man. There is a *third* inner eyelid, highly developed and of beautiful mechanism: this is the *nictitating* membrane, or "winker" (*nictito*, I wink), a delicate, elastic, translucent, pearly-white fold of the conjunctiva. While the other lids move vertically and have a horizontal commissure, the winker sweeps horizontally or obliquely across the ball, from the side next the beak to the opposite. If we menace a bird's eye with the finger, it is curious to see the winker rush out of the corner to protect the ball. Owls habitually sit in the daytime with this curtain shading

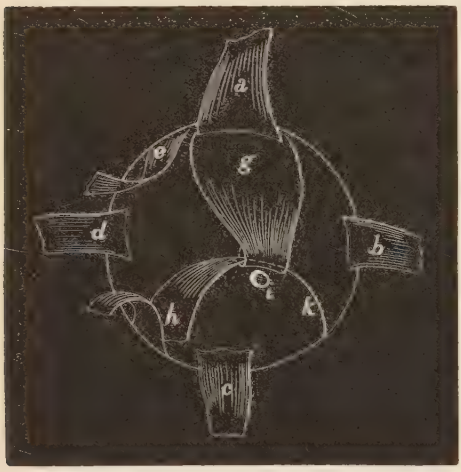


FIG. 81. — Right eye-ball, seen from behind, showing the muscles: *a*, rectus superior; *b*, rectus externus; *c*, rectus inferior; *d*, rectus internus; *e*, obliquus superior; *f*, (not lettered) obliquus inferior; *g*, quadratus; *h*, pyramidalis, with its tendon, *k*, passing through a pulley in the quadratus (as shown by the dotted line) to keep it off the optic nerve, *i*, then passing around the edge of the ball to its insertion in the nictitating membrane.

the eyes from the glare of light; and doubtless the eagle throws the same screen over its sight when soaring towards the sun. When not in action, the winker lies curled up in the corner of the eye, like those patent window shades which stay up of themselves till pulled down. The ingenious mechanism of the movement of the winker across the lid may be understood with the help of fig. 81, which represents the *back* of the eye-ball. The winker lies in front, on the left hand of the picture, and is to be pulled across the front by the slender tendon, *k*, of the *pyramidalis* muscle, *h*. As *h* contracts it pulls on *k*, and *k*, winding round to the front, pulls the winker to the right hand. But *i* is the optic nerve, entering the ball; *k* would press upon it, were it not fended off by passing, as seen by the dotted line, through a pulley in the end of the *quadratus* muscle, *g*. The harder *h* pulls, the harder does *g* also pull, their consentaneous action at once giving the proper direction to the tendon *k*, and keeping it off the nerve.

Beneath the eye-lids, upon the ball, is a delicate filmy membrane not easily recognized on ordinary inspection: this is the *conjunctiva*, so called because it joins the eye to the lids. The *ocular* layer is transparent where it passes over the cornea: it is then reflected away from the ball, to form the *palpebral* layer, — a folding between being the nictitating membrane. The conjunctiva is highly vascular, but the blood-vessels are too small to be seen unless they become congested, when the eye presents the well-known appearance called blood-shot. Though birds can hardly be said to cry, they have a well-developed apparatus for the manufacture of tears. The lacrymal are two small glands lying one in each corner of the eye, inner and outer. The former, called the *harderian* gland, is the smaller, deeply seated behind the winker, upon which it pours a glary fluid: it is an oil-can which not only supplies but applies the fluid to the winker, which needs constant lubricating to work well. The lacrymal gland proper is the outer one, which prepares the tears to moisten and cleanse the conjunctiva; after which they are drained off by the lacrymal duct into the cavity of the nose, which thus becomes a sort of cesspool to receive the refuse waters of the eye. A third gland about the orbit has been already mentioned (p. 178) as pertaining to the nose, not to the eye. Its site is shown in the crescentic super-orbital depression, fig. 63, *w*.

The motions of the eye-ball, though more restricted than in mammals, owing to the shape of the ball and its close socketing, are nevertheless subserved by the usual number of *six* muscles. Of these four are called the *recti*, or straight muscles, and two the *obliqui*, or oblique muscles; though they are all "straight" enough, the terms applying to their lines of traction. The four *recti* arise from the bony orbit, near together, about the optic foramen, and pass to be inserted in the eye-ball at as many nearly equidistant points on its circumference; the *musculus rectus superior*, fig. 81, *a*, on top; *m. r. inferior*, *c*, below, antagonizing *a*; the *m. r. externus*, *b*, and *internus*, *d*, respectively to the outer and inner (hindward and forward) sides, also antagonizing each other. The two oblique muscles arise further forward in the bony orbit, near each other, and then diverge obliquely upward, *m. o. superior*, *e*, and downward, *m. o. inferior*, *f*, to be inserted near the margin of the globe of the eye, close by the respective insertions of superior and inferior rectus. All the motions of the ball result from consentaneous or dissentaneous action along these six lines of traction; the muscles acting as ropes to pull the ball about, and to steady it in any direction of its axis. The peculiarity of mechanism in a bird is, that the superior oblique goes straight to its insertion, instead of passing through a pulley which changes its line of action in mammals. The special nerves presiding over these muscles (3, 4, 6) have been pointed out already (p. 177). In the figure, the cut orbital ends of them all are reflected away from the ball to disclose the underlying muscles of the winker: the reader must mentally bring the six loose ends together and fasten them to the bony orbit at points near about opposite *i*, as above said of their origins.

The above are the principal circumstances and accessories of the optic apparatus; we may now examine the eye itself, of which fig. 82 gives an enlarged view, in longitudinal vertical section, — the nerve, marsupium, and ciliary processes not indeed lying as shown in this section,

but so introduced as to show them up intelligibly. A bird's eye-ball is not nearly so spherical or globular as a mammal's. The globe of the human eye is about a five-sixths segment of a large sphere (sclerotic) with a one-sixth segment of a smaller sphere protruding in front (corneal). The anterior part of the sclerotic of a bird is so prolonged as to be in some cases almost tubular or cylindric, and the corneal protuberance is very convex: the result may be likened to an acorn which has a short blunt kernel in a heavy shallow cup, or to a thick old-fashioned watch with a very convex crystal. This characteristic shape is fairly shown in the figure; but some birds' eyes are much more tubular in front, — owls' for example. The eye-ball being hollow and filled with fluids which press in all directions, it is hard to see at first how such a peculiar shape is maintained. But the sclerotic coat is very dense, almost gristly in some cases; and it is reinforced by a circlet of *bones*, the *sclerotals*, *h*, *h*; see also fig. 62, where the circlet is shown. These are packed alongside each other all around the circumference of one part of the sclerotic, like a set of splints. The large discoidal segment of a bird's eye is mostly composed of the membrane called from its hardness the *sclerotic*, — thick, tough, and strong, of a glistening livid color. Three sclerotic coats or layers may be demonstrated by careful dissection; in the figure *b* is the outer, *c* the combined middle and inner ones, — much exaggerated as to their distinctness. The bony plates lie between the outer and middle coats anterior to the greatest girth of the eye-ball, extending from the rim of the disc nearly or quite to the edge of the cornea. They are a dozen to twenty in number, of oblong squarish shape, tapering toward the cornea, around which they are thus circularly disposed; they are pretty closely bound together, but the circlet as a whole enjoys some little motion back and forward with the varying convexity of the *cornea*, *g*. This last is the thin transparent membrane completing the eye-ball in front, like the crystal over the face of a watch. It is very protuberant in birds, — even a hemisphere, or almost tubular. Its structure is not peculiar in birds; but it is remarkable in this class of creatures not only for its convexity, but for the wide range of the variability in convexity which increased or diminished pressure of the contained humors may effect, and its collapse in death.

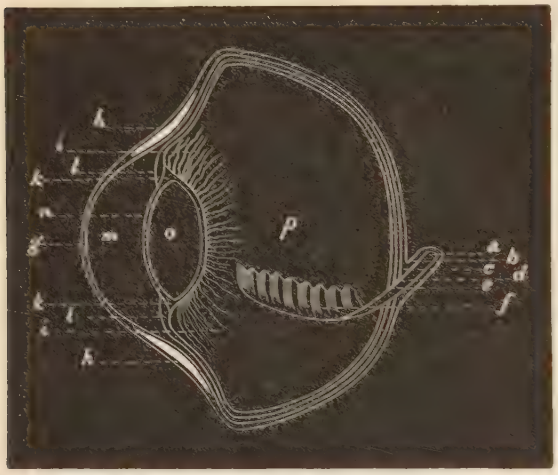


FIG. 82. — Vertical antero-posterior section of eye-ball: *a*, optic nerve; *b*, sclerotic, its outer coat; *c*, sclerotic, its middle and inner coats; *d*, choroid; *e*, hyaloid; *f*, marsupium; *g*, cornea; *h*, *h*, bony plates between sclerotic layers; *i*, *i*, corrugations of choroid, forming ciliary processes; *k*, *k*, canal of Petit; *l*, *l*, iris; *m*, anterior chamber of eye; *n*, capsule of the lens; *o*, lens; *p*, posterior chamber of eye. Neither the retina, nor the peculiar sheathing of the optic nerve, is shown. The nerve, marsupium, and ciliary processes, not falling in this section, can only be arbitrarily shown.

The sclerotic coat is lined with the *choroid membrane*, *d*, loosely woven of cellular tissue, replete with blood-vessels, and painted pitch-black with a heavy deposit of pigment-cells. It lines the whole globe as far forward as the edge of the sclerotal bones, where it splits in two layers. The *inner* choroid layer turns away from the wall of the eye, toward the interior, and in so reflecting becomes plaited, as a bag is puckered by pulling the strings. These pleats converge upon the rim of the delicate capsule enclosing the lens of the eye, *n*, and there adhere, forming the *ciliary processes*, *i*, *i*. The *outer* layer also starts away from the circumference of the sclerotic wall, as if to pass directly across the cavity, but ends in the *iris*.

Around the circumference of the iris, where sclerotic, corneal, and choroid coats come together, is a circular band of fibres, the *ciliary ligament;* and on the outer surface of the choroid is a similar band of circular and radiating contractile fibres, the *ciliary muscle.* These ciliary structures are supposed to be the agents of the accommodating faculty of the eye, acting upon the lens to alter its shape or its position, or both. It is a difficult matter to settle, when such delicate structures are in question.

The *iris*, *l*, *l*, or rainbow of the eye, is an exquisite structure hanging like a many-colored curtain vertically between the two compartments of the eye; a highly ornamental framework of the eye's window, being both sash and blind to the pupil. It is suspended vertically in the *aqueous* humor, just in front of the lens. Viewed in front, from the outside, the iris appears as a colored circular band around the pupil, and seems to come to the surface of the eye. But this is not so, for the conjunctiva, the cornea, and the aqueous humor of the front chamber of the eye, are between us and it. It may be likened to the dial-plate of a watch, which we look at without noticing the interposed crystal. Similarly, the *pupil* of the eye, which shows us our own reflection, diminished to the size of the "eye-baby," may be likened to the round central hole in the dial-plate through which protrudes the shaft that bears the hands of a watch. The "pupil" is the round black spot within the colored rim of the iris; but it is not a thing — it is a hole in a thing — the hole in the iris through which we may look and see the black choroid coat behind. The quivering iris is very similar in texture to the choroid, being a delicate tissue of interlacing fibres and vessels; but it is highly mobilized by circular and radiating sets of contractile fibres, by which the curtain is tightened and loosened, with corresponding change in the size of the central orifice — the pupil. Although the iridian movements are largely automatic, depending upon the stimulus of light, they are to some extent voluntary, as any one may satisfy himself who observes owls in confinement. During these expansions and contractions of the iris, the pupil in birds preserves its circularity; and even when the movement is freest and most voluntary, as in owls, the contracted pupil never appears as a vertical oval figure, or a slit, like that of cats. The round pupil of the great horned owl ranges from the diameter of a finger ring down to that of a small split-pea. The iridian colors are often striking in birds. Though black and brown are the commonest, yellow is quite frequent, red is often seen, blue and green are rarer; the eyes of cormorants are of the latter color. The iris is sometimes pure white, as it is in our common "white-eyed" greenlet, *Vireo noveboracensis.* In the Californian woodpecker, *Melanerpes formicivorus*, the eyes are indifferently (or at different ages of the bird, or seasons) brown, bluish, pink, rosy, or yellow.

The *crystalline lens*, *o*, is a transparent biconvex disc, like a common magnifying glass, apparently set in the iris like a mirror in its frame, but really hanging a little back of that structure. It is enclosed in a capsular membrane, *n*, of extreme delicacy and transparency, which is in turn set between two layers of the hyaloid membrane to be presently noticed. Where these layers of hyaloid separate around the rim of the capsule to form the investment, a small space is left between them; this circular tube around the lens is the *canal of Petit*, *k*, *k*. The lens is stationed in the axis of vision; some suppose it to be equally stationary in any transverse axis. It is, however, difficult to understand how an object thus suspended in fluctuating humors should be insusceptible of some motion backward or forward, as well as of alteration in its degree of convexity; both of which may be factors in the focusing process. From what has preceded, it is evident that the cavity of the eye is divided into anterior and posterior compartments, or chambers, by the reflection, from the sclerotic wall, of the choroid, hyaloid and iridian structures, which with the lens form a vertical partition. Each chamber is filled with a fluid of different density and consistence. That in the anterior or corneal chamber is thin and watery, and therefore called the *aqueous humor;* that in the sclerotic cavity is more dense and glassy, and for this reason known as the *vitreous humor.* There is much less aqueous than vitreous; but birds have comparatively more of the former than usual,

owing to the relatively greater size and convexity of the cornea. The waters are enclosed in exceedingly delicate membranes: the vitreous in the *hyaloid membrane*, *e*, which, besides lining the posterior chamber and enclosing the lens as already said, sends thin partitions all through the vitreous humor to steady these glassy waters.

The *optic nerve*, *a*, of birds is peculiar. In mammals, as a rule, the nerve is a smooth cylinder, proceeding straight to the sclerotic, penetrating the coats of the eye-ball directly, near the middle point behind, and then spreading out on the inside of the ball as a large circular concave mirror. This thin, saucer-like expansion of nerve-tissue is the *retina*. In birds the optic nerve is a fluted column, which approaches the eye-ball quite obliquely, strikes it at a point eccentric from the axis of the eye, and does not at once pierce the sclerotic. Tapering to a fine point, and running still obliquely, downward and forward, in a deep groove in the sclerotic that would be a tube were it not split, and through a similar slit in the choroid, a fluting of the nerve rises to attain the cavity of the eye, and the retina spreads out from the sides and end of this fold. But the prime peculiarity of a bird's eye is the "purse" or "comb," *marsupium*, *pecten*, *f;* a very vascular structure, like the choroid, and likewise painted black; apparently "erectile," that is, capable of increasing and diminishing in size by influx and efflux of blood. It is attached behind to the nervous structure; is suspended in the vitreous humor, and runs forward obliquely a part or the whole of the way to the lens, to the envelope of which it may be attached in some cases. Its office is not fully determined. Its great resemblance to the choroid proper suggests a similar function in the absorption of light. If it be turgid and flaccid by turns it must occupy a variable space in the vitreous humor, and in the former state press the waters upon the most yielding part of their walls, — that where the lens is situated, even to the extent of altering the position of the latter; and if so, of changing the focus of the eye. It is difficult to account for the bird's eyes' powers of accommodation by the action of the ciliary muscle in only changing the *shape* of the lens, thus throwing out of account as impossible any change in the position of that refracting medium, or of the density of the refracting humors, or of the convexity of the cornea. The peculiar course of the optic nerve may be simply an anatomical convenience, or may have something to do with a bird's ability to see straight ahead though its eyes be laterally positioned. (See Am. Nat., ii, 1868, p. 578; Pr. Bost. Soc. Nat. Hist., xii, Apr. 21, 1869.)

Sense of Hearing: Audition. — This is enjoyed to a high degree by the "musical class" of the *Vertebrata*, — birds being the only animals besides man whose emotions are habitually aroused, stimulated, and to some extent controlled by the appreciation of harmonic vibrations of the atmosphere. Most birds express their sexual passions in song, sometimes of the most ravishing quality to our ears, as that of the nightingale or the bluebird, and it cannot be supposed that they themselves do not experience the effect of music in an eminent degree of pleasurable perturbations. Otherwise, they would cease to sing. The capability of musical expression resides chiefly in the more spiritualized male sex: the receptive capacity of musical affections is better developed in the female, who chiefly furnishes the plastic material which is to be moulded into the physical manifestation of the male principle. Quickness of ear is extraordinary in such birds as those of the genus *Mimus*, which correctly render any notes they may chance to hear, with greater readiness and accuracy than is usually within human possibility. It may be reasonably doubted that any others than some of the world's greatest musical composers have a higher experience in acoustic possibilities than many birds. Birds' ears have nevertheless a comparatively simple anatomical structure, on the whole much more like that of reptiles than of mammals. Such simplicity is seen in the ligulate or strap-shaped cochlea, the essential organ of hearing, figs. 84, 85, 86, 87, as compared with the helicoid curvation of the mammalian cochlea. The openness of the ear-parts which lie outside the tympanum is seen in fig. 62, at the place where the reference-lines "ear-cells" reach the skull; and

especially in fig. 71, where the stapes, *st*, is seen lying in the ear-cavity, the tympanum having been removed.

There is ordinarily no external ear, in the sense of a fleshy conch or auricle, though owls at least have a considerable flap which overlies the auditory aperture. The place of an auricle is filled by a set of peculiarly modified feathers surrounding and overlying the opening, called in ornithology the ear-coverts, or *auriculars* (p. 97; fig. 25, 36). The outer ear or *meatus auditorius externus* is a considerable shallow roundish depression in the skull, at the extreme lower lateral corner. Its ordinary boundaries are the movably articulated quadrate bone in front, the expanded rim of the squamosal above, the tympanic wing of the exoccipital behind and below; the termination of the basitemporal also usually contributing to the under boundary. (See fig. 71, at *st;* 63, under *l;* fig. 62, where reference lines "bones of ear cell" go.) On removing the quadrate from the dry skull, the general tympanic depression is seen to be more or less continuous with the alisphenoid; the boundary is best marked behind and below by the broad thin sharp-edged shell of the tympanic wing of the exoccipital. To the brim indicated is attached the *tympanum*, or drum of the ear — that membrane being, from the configuration of the parts, quite superficial, — not at the bottom of a tube-like meatus, as in man. The membrane proper is invested externally by modified common integument which readily peels off. Thus this wide shallow depression overlaid with feathers or a slight flap is all there is to represent the "outer ear-passage." The tympanic membrane sometimes develops slight ossification, which then represents the "tympanic bone," or "external auditory process" of human anatomy. Did not this membrane occlude the way, the passage through the ear to the mouth would be pervious. This passage is the modified persistence of the *first visceral cleft* or "gill-slit" of the embryo. Just within the tympanic membrane is the *cavity of the tympanum* or *middle ear*, which may be very extensively exposed by merely removing the membrane. Looking into this cavity, as may readily be done from the outside, in carefully cleaned dry skulls, many objects of interest are presented; among them, a number of foramina — openings leading in various directions. In the first place there are some (inconstant and not readily identified) holes, which are *pneumatic* openings, conveying air from the middle ear-passage to the interior of bones of the skull and lower jaw. Next is observed a large orifice in the lower anterior part of the cavity, — the mouth of the *eustachian tube.* This tube continues the ear-passage to the mouth; opening at the back of the hard palate by a median orifice in common with its fellow. In clean skulls of any size a bristle, or even a wooden tooth-pick, will pass through the eustachian tube, and appear upon the floor of the skull in mid-line or nearly there, under the basisphenoid, over the basitemporal. The foregoing passages have not conducted us to the *inner ear* or proper acoustic cavity. There will be observed, in the side-wall of the tympanic cavity, two definite openings near the eustachian orifice. One of these, anterior and superior to the other, larger usually, and oval, is the *fenestra ovalis;* it lies in the obliterated suture between the proötic and opisthotic bones; and when the membranous curtain which closes it in life is gone, you look through this "oval window" into the *vestibular cavity* of the ear proper. The lower, posterior, circular orifice is the *fenestra rotunda;* through which round window in the opisthotic bone you look into the *cochlear cavity* of the ear proper. Fenestra ovalis and f. rotunda are generally close together, — only divided by a little bridge of bone, or a mere bony bar. To the circumference of the fenestra ovalis is fitted the expanded oval foot of the trumpet-shaped *columella auris*, — the *stapes*, or "stirrup-bone," as it is called in mammals (fig. 83, *st*). This is an elegant little bone, which establishes mechanical connection between the membrane closing the fenestra ovalis and the tympanic membrane, — something on the principle of the "sounding-post" inside a violin. It is shown magnified greatly in its embryonic condition, in fig. 67, and there seems to be primitively and morphologically the proximal connection of the *hyoid bone* (by cerato-hyal elements) with the bony capsule of the ear; but no trace of this relation persists. Fig. 83 shows the mature stapes of a fowl, and indicates its

several elements which have received special names. In skulls prepared with sufficient care, the stapes may be seen *in situ*, as in fig. 71, *st*, — an extremely delicate rod, stepped into the fenestra ovalis by its foot, the other end protruding freely, and bearing in many cases its hammer-like or claw-like stapedial elements. A stapes I have just picked out of an eagle's ear is a fourth of an inch long, with a stout foot, but a stem as fine as a thread of sewing silk, and at the tympanic end a still finer hair-like process half as long as the main stem, from which it stands out at a right angle. The ossification is perfect, and there appears to have been another similar process which has broken off from the cross-like figure shown in fig. 71, *st*. In a raven's skull before me the stapes has fallen into the fenestra ovalis, and lies there with its head sticking out, though perfectly loose. I cannot withdraw it intact, as the expanded foot fits the hole too closely to pass through in any position I have succeeded in placing it. It appears to be about as large as the eagle's. Close examination at a point somewhere about the fenestra ovalis, or between that and the eustachian orifice, will discover a minute foramen, corresponding to the "stylo-mastoid" foramen of mammals. It transmits cranial nerve 7 (see p. 177), or the *facial nerve*, which has burrowed through the bony acoustic capsule from the brain-cavity and entered the tympanic cavity on its way to the surface. There are sometimes *two* such minute foramina, close together, both conducting to the brain cavity (neither in common with the internal auditory meatus); as in the eagle, in which large bird a fine bristle just passes through each. Thus in the dry skull of a bird, all the hard parts of the middle ear or tympanic cavity, as well as the eustachian tube, can readily be inspected from the outside; even the limits of the opisthotic and proötic bones can be determined to some extent, and the *ossiculum auditûs* be seen *in situ*. There will also be noted, in most birds, the articular facet upon the proötic bone for the inner head of the quadrate, as well as upon the squamosal for the outer head of the quadrate; however these may shift in position, in different birds, they cannot easily be overlooked or mistaken. Details of mere size and configuration aside, the above general description will apply pretty well to any bird, and should suffice for the identification of the objects seen on looking into the ear, though the number and variety of the irregular *pneumatic* openings may be puzzling at first. To see these things clearly in a *mammal's* ear would require special preparation of the parts, as they lie inside a tympanum which is itself at the bottom of a contracted tube. In such an ear, properly laid open, would be found a chain of *three* ossicles crossing the tympanic cavity from the inner surface of the tympanic membrane to the opposite surface of the membrane closing the fenestra ovalis — the *malleus*, *incus*, and *stapes*, or "hammer," "anvil" and "stirrup;" and the latter would be stirrup-shaped, not trumpet-like with a cross-bar at the mouth-piece. Some mammals would also show a hyoid bone which would have what are the cerato-hyals of a bird produced up toward the ear-parts, and continued to these by a bone called *stylo-hyal*, or "styloid process of the temporal"; and any mammal's jaw would articulate directly with the squamosal, — the chain of three ossicles being entirely inside the ear. As to comparing the parts now: the mammalian stapes is the stapes or columella of a bird, — its stem and foot at least; the incus of a mammal is represented by one of the claws of the cross-bar of a bird's stapes (the *supra*-stapedial element; fig. 83, *sst*); the malleus of a mammal is the great quadrate bone of a bird; the stylo-hyal of a mammal is not fairly developed in a bird, unless contained in or represented by another claw of the stapes (an *infra*-stapedial element, *ist*); and in these facts is the reason why a bird's lower jaw is articulated indirectly to the skull by means of the quadrate, and also why a bird's hyoid bone is not articulated or in any way

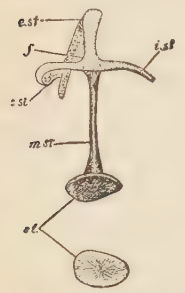


FIG. 83. — Mature stapes of fowl, about × 4; after Parker. *st*, its foot, fitting fenestra ovalis; *mst*, main shaft, or medio-stapedial element; *sst*, supra-stapedial; *est*, extra-stapedial; *ist*, infra-stapedial, its end representing a rudimentary stylo-hyal; *f*, a fenestra in the extra-stapedial. (See *st* in situ, fig. 71, and its embryonic formation, fig. 67.)

directly connected with the skull — excepting when, as in a woodpecker, elongated *branchial* elements of the hyoid bone take on such office by curling over the cranium (figs. 73, 74).

Section of the bone is required for further examination of the ear-parts. On longitudinally bisecting the skull, or otherwise gaining access to the brain-cavity, the internal surface of the *periotic* bone is brought into view (fig. 70, *po*, *op*, *ep*). It is the same bone we have seen in the tympanic cavity, now viewed upon its cerebral surface. In a skull of any size, as that of the eagle before me (from which the rest of my description will be taken), there is no difficulty in making out the parts, although the periphery of the periotic bone is completely consolidated with its surroundings. The periotic, or *petrosal* (Lat. *petrosus*, stony — from its hardness), or "petrous part of the temporal," is the bony capsule of the inner ear, enclosing the *labyrinth* or essential organ of hearing, — in fact, it is the skull of the ear, sometimes therefore called the *otocrane* — just as ethmoidal parts form the "skull of the nose," and the sclerotal bones represent a "skull of the eye." The periotic consists of the three bones already often mentioned, — the *proötic*, *po*, *epiotic*, *ep*, and *opisthotic*, *op*, or anterior, superior, and posterior otocranial bones, completely consolidated together, as well as with surrounding bones. The petrosal appears as an irregular protuberance in the inner wall of the brain-cavity, at the lower back part. It seems to be more extensive than it really is, because the great superior semicircular canal, too large to be entirely accommodated in the petrosal, has invaded the occipital bone, — the track of its bed in that bone being sculptured in bas-relief (fig. 70, *asc*). Behind this semicircular trace, the deep groove of a venous sinus is engraved in the bone, making the tract of the canal still more prominent (fig. 70, *sc*). The top of the petrosal and contiguous occipital is the floor of a recess or *fossa* in which is lodged the great optic lobe of the brain, partly divided from the general cavity for the cerebral hemisphere by a bony tentorium, like that which in mammals separates the cerebellar from the cerebral fossæ. On the vertical face of the petrosal, or on the corresponding occipital surface, is a large smooth-lipped orifice, at least $\frac{1}{10}$ of an inch in longest diameter; it leads to a tongue-like excavation of the bone, in which the *flocculus* of the cerebellum is lodged. In front, between the petrosal and alisphenoid (or in the conjoined border of one or the other of these bones) is a considerable foramen, conducting the second and third divisions of cranial nerve 5 (see p. 177; figs. 70, 71, ^{5}) into the *orbit*. Below the petrosal (in fact, between the opisthotic and the exoccipital), near the border of the foramen magnum, is a foramen (which may be subdivided into foramina), representing the *foramen lacerum posterius* of mammals, transmitting cranial nerves 9, 10, 11 (see p. 177; fig. 70, ^{8}). The general space under description is continued to the margin of the foramen magnum by the exoccipital (fig. 70, *eo*). Now on the vertical face of the petrosal itself — behind foramen for 5, above that for 9, 10, 11, in front of the large floccular orifice, will be seen a smooth-lipped depression, the *meatus auditorius internus* (fig. 70, ^{7}), at the bottom of which are at least *two separate* small foramina. A bristle passed in the upper (or anterior) one of these two holes emerges outside the skull, in the tympanic cavity, near the tympanic end of the eustachian tube; it has traversed the interior of the petrosal, in a track known as the *fallopian nerviduct;* it transmits cranial nerve 7 — the *facial*, or *portio dura*. A bristle passed into the other of the two foramina may also be made to come out in the tympanic cavity, but by a different track, for it emerges through either the fenestra ovalis or the fenestra rotunda; it has traced the course of cranial nerve 8, — the *auditory nerve* or *portio mollis*. Both bristles have entered the common internal auditory meatus, but the second one has traversed the ear-cavity proper, through the *labyrinth* of the ear, and come out at the tympanic *vestibular* orifice (fenestra ovalis), or at the tympanic *cochlear* orifice (fenestra rotunda). Either passage is easily made, without breaking down or indeed meeting with any bony obstacle, which would not be the case with a mammal. Cranial nerves 7 and 8 were formerly counted as one (seventh); hence the name *portio dura* ("hard portion") for the former, and *portio mollis* ("soft portion") for the latter. The former, as said, traverses the petrosal bone and escapes upon the face; the latter, which is the true acoustic nerve, or

nerve of hearing, remains in the bone, being expended upon the labyrinthine structures within — the *vestibule, semicircular canals,* and *cochlea,* which constitute the walls of the cavities in which the essential organ of hearing is snugly encased.

If now, with a very fine saw — the saws now so much used for fancy scroll-work will answer the purpose — the whole periotic mass be cut away from the skull, and then divided in any direction, the labyrinth can be studied. It is best to make the section in some definite plane with reference to the axes of the whole skull, — the vertical longitudinal, or vertical transverse, or horizontal, — as the direction and relations of the contained structures are then more easily made out. Four or five parallel cuts will make as many thin flat slices of bone, affording eight or ten surfaces for examination; the whole course of the labyrinthine cavity can be seen in sections which, when put together in the mind's eye, or held a little apart in their proper relations and visibly threaded with bristles, afford the required picture very nicely. It is extremely difficult to chisel out the affair from the bone in which it is embedded. At first glance the slices show a bewildering maze, — a continuous net-work or lattice-work of bone, in which the unaccustomed eye will recognize nothing but confusion. All this *cancellated* structure, however, is pneumatic — the open-work tissue of the bone, containing air derived from the tympanic or eustachian cavities, and having nothing to do with the ear-passages proper. Parts of the *bony labyrinth* will soon be recognized by their firm smooth walls and definite courses, as distinguished from the irregular interstices of the pneumatic bone-tissue. The bony labyrinth consists of an irregular central cavity, the *vestibule;* of a cavity, projecting like a beak downward and backward from the vestibule, the *cochlea;* and of three horseshoe-shaped tubular cavities, above, behind, and below the vestibule, the *semicircular canals,* the ends of whose hollows all open into the vestibule. Imagine three hollow horseshoes, with their ends melted into a hollow inflation (vestibule), the opposite wall of which is a hollow projection (cochlea) — or a hollow flat-iron (vestibule) with a long nose (cochlea) and three hollow handles (the canals). Or, see figs. 84 to 87, representing the contained *membranous* labyrinth, to which the containing bony labyrinth very closely conforms, as it is simply the bony cavity whose walls encase the membranous and other soft structures. According as the sections have been made, numerous cross-cuts of the canals will be seen here and there as circular orifices; the canals themselves lying curled like worms in the petrosal and occipital substance, their ends finally converging to the vestibular cavity. As compared with those of man, the parts are of great size; in the eagle, the whole affair is as large as that part of one's thumb covered by the nail; the whole length of the superior semicircular canal is an inch or more; its calibre, I should judge, being absolutely about as great as in man. The cochlea, however, though not diminutive comparatively, is in a rudimentary condition as far as complexity of structure is concerned, in all *Sauropsida,* representing only the beginning of the cochlear structure of mammals. In the latter class, the cochlea is spirally coiled or whorled on itself like a snail-shell (whence the name — *cochlea,* a snail), making at least one turn and a half, sometimes five (two and a half in man); with a centre-post or *modiolus* around which winds a bony flange, the *lamina spiralis,* a membranous extension of which to the cochlear out-wall divides the cavity into two compartments or *scalæ* (*scala,* a flight of stairs); it is just like a spiral stairway, only an inclined plane instead of a series of steps. The membranous extension of the bony spiral lamina to the side-wall obviously throws the cavity, as just said, into *two* spirals, which only intercommunicate at the top, where the modiolus ends in a funnel-shaped expansion, the *infundibulum,* beneath the apex of the snail-shell, the *cupola.* A marble rolling down the *upper* stairway would fall into the *vestibular* cavity; this division of the cochlea is therefore the *scala vestibuli.* The marble starting from the other side of the infundibulum would roll along the under stairway, and if nothing stopped the way, would fall through the fenestra rotunda into the tympanic cavity; this is therefore the *scala tympani.* The first marble would also eventually reach the tympanum, through the vestibule, and out of the fenestra ovalis, if the foot of the

stapes were unstepped (in life, of course, both these "windows" are closed by membranous curtains). Now in birds the cochlear cavity and its bony or cartilaginous contents are only the beginnings of such structure — a strap-shaped or tongue-like protrusion from the vestibule, as if a part of the first mammalian whorl, and very incompletely divided into scala vestibuli and scala tympani by a gristly structure (representing the modiolus and its lamina), which proceeds from the bony bar or bridge between fenestra ovalis and fenestra rotunda. (See figs. 84, 85.) This structure is the most intimate and essential part of the organ of hearing, for upon it spread the terminal filaments of the auditory nerve. A human or any well-developed mammalian cochlea is a thing of marvellous beauty, even as to its bony shell — there is nothing to compare with its exquisite symmetry; while the spiral radiation of the nervous tissue introduces yet other and more wondrous "curves of beauty."

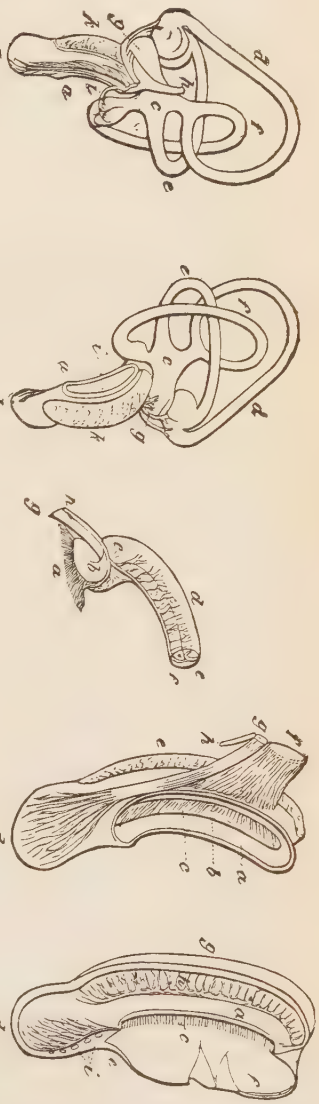


FIG. 84.

FIG. 85.

FIG. 86.

FIG. 87.

FIG. 88.

Figs. 84, 85, membranous labyrinth of *Haliaëtus albicilla*, ×2. *a*, *b*, cochleæ; *b*, its saccular extremity (or lagena); *c*, vestibule; *g*, its utricle; *d*, anterior or superior vertical semicircular canal; *e*, external or horizontal semicircular canal; *f*, posterior or inferior vertical semicircular canal; *h*, membranous canal leading into aqueduct of the vestibule; *k*, vascular membrane covering the scala vestibuli; opposite this, at *i*, are seen the edges of the cartilaginous prisms in the fenestra rotunda; from the edges of these cartilages proceeds the delicate membrane closing the opening of the cochlea (not shown in the fig.).

Fig. 86, part of the superior vertical semicircular canal, showing its ampulla (which is the dilatation of the base of any semicircular canal), nerve of ampulla, artery and connective tissue of the perilymph, × 3. *a*, that part of the vestibule (alveus) next to the ampulla; *b*, the dilatation of the ampulla at its vestibular opening; *c*, where it passes into the canal proper; *d*, the canal, furnished with connective tissue of the perilymph along its concave border and sides, as appears clearly at the sections *e* and *f*; *g*, nerve of the ampulla; *h*, artery of the connective tissue, running beneath it, remote from the wall of the duct.

Fig. 87, cochlea, × 3. *a*, external, *b*, internal, cartilaginous prism; *c*, membranous zone; *d*, saccular extremity of the cochlea, or lagena; *e*, vascular membrane; *f*, auditory nerve, its middle fascicle penetrating the internal cartilaginous prism, to reach the membranous zone by its terminal filaments; *g*, auditory nerve, its posterior fascicle, running to the most posterior part of the lagena; *h*, filament to ampulla of posterior or inferior vertical semicircular canal.

Fig. 88, section of the cochlea, × 3. *a*, vestibular surface of external cartilaginous prism, extending into *d*, the lagena; *c*, section of the membranous zone; *e*, Huschke's process of the fenestra, which, with the margins of the cartilaginous prisms, affords attachment to the blind sac *f*, occluding the fenestra of the cochlea; *g*, spongy vascular membrane of the scala vestibuli; *h*, auditory lamellæ of Treviranus; *i*, canals in posterior wall of the lagena, by which the nervous filaments enter its cavity.

(From Ibsen's Anatomiske Undersögelser over Örets Labyrinth. 4to, Kjöbenhavn, 1881, p. 17, pl. 1, figs. 13-17.)

The *vestibule* hardly requires special description; it is simply the central chamber common to the cochlear and canalicular cavities; receiving the mouth of the scala vestibuli of the cochlea; the several mouths of the separate or uniting semicircular canals; opening into tympanum by fenestra ovalis; conducting to meatus auditorius internus by the course of the auditory nerve. In the eagle, if its irregularities of contour were smoothed out, it would about hold a pea.

In the language of human anatomy, the three *semicircular canals* are the (*a*) anterior or superior vertical, the (*b*) posterior or inferior vertical, and the (*c*) external or horizontal; and the planes of their respective loops are approximately mutually perpendicular, in the three

planes of any cubical figure. In birds these terms do not apply so well to the situation of the canals with reference to the axes of the body, nor to the direction of the loops; neither is mutual perpendicularity so nearly exhibited. The whole set is tilted over backward to some degree, so that the (*a*) "anterior" (though still superior) loops back beyond either of the others; the (*b*) "posterior" loops behind and below the (*c*) horizontal, which tilts down backward; the verticality of the planes of (*a*) and (*b*) is better kept. The canals may be better known as the (*a*) superior (vertical), and (*b*) inferior (vertical), and (*c*) internal (horizontal). Whatever its inclination backward, there is no mistaking (*a*), much the longest of the three, looping high up over the rest, exceeding the petrosal and bedded in the occipital, the upper limb and loop of the arch bas-relieved upon the inner surface of the skull (fig. 70, *asc*). It makes much more than a semicircle — rather a horse-shoe. The inferior vertical (*b*) loops lowest of all, though little if any of it reaches further backward than the great loop of (*a*); it is the second in size; in shape it is quite circular, — rather more than a half-circle. Its upper limb joins the lower limb of (*a*), as in man, and the two open by one orifice in the vestibule; but it is not simple union, for the two limbs, before forming a common tube, twine half-round each other (like two fingers of one hand crossed). The loop of (*b*) reaches very near the back of the skull (outside). The canal (*c*) is the smallest, and, as it were, set within the loop of (*b*), though its plane is nearly the opposite of the plane of (*b*); and the cavities of (*b*) and (*c*) intercommunicate at or near the point of their greatest convexity, farthest from the vestibule. This decussation of (*b*) and (*c*), like the twining inosculation of (*a*) and (*b*), is well known. It may not be so generally understood that there is (in the eagle if not in birds generally) a *third* extra-vestibular communication of the canals. My sections show this perfectly. The great loop of (*a*), sweeping past the decussating-place of (*b*) and (*c*), is thrown into a cavity common to all three. Bristles threaded either way through each of the three canals can all three be seen in contact, crossing each other through this curious extra-vestibular chamber, which may be named the *trivia*, or "three-way" place. (The arrangement I make out does not agree well with the figure of the owl's labyrinth given by Owen, *Anat. Vert.*, ii, 134. The trivia is at the place where, in fig. 84 or 85, the three *membranous* canals cross one another. It does not follow, however, that these contained membranous canals intercommunicate, and it appears from Ibsen's figures that they do not. Study of these admirable illustrations, with the explanations given under them, should make the details perfectly clear to the reader.)

All that precedes relates to the *bony* labyrinth, — the scrolled cavity of the periotic bone. The *membranous labyrinth* is a sac lying loosely in the hollow of the bone, and shaped just like it, lining the hollow of the vestibule and tubes of the semicircular canals. Withdrawn intact, it would be a perfect "cast" of the labyrinth. Originally, this sac is also continuous with one in the cavity of the cochlea, called the *membranous cochlea*, which afterward becomes shut off from the main sac. This shut-off cochlear part lies between the scala tympani below and the scala vestibuli above; its interior is the *scala media*. If demonstrable in birds, it must be quite as rudimentary as the other scalæ. The membrane is not attached to the bony walls of the labyrinth, but is separated by a space containing fluid, the *perilymph*, which also occupies the scala vestibuli and scala tympani. A similar fluid, the *endolymph*, is contained in the cavity of the membranous labyrinth, and scala media of the cochlea; in it are found concretions, or *otoliths*, of the same character as the great "ear-stones" so conspicuous in many fishes. This lymph has a wonderful office — that of *equilibration*, enabling the animal to preserve its equilibrium. The labyrinth and its contained fluid may be likened to the glass tubes filled with water and a bubble of air, by a combination of which a surveyor, for example, is enabled to adjust his theodolite true to the horizontal. Somehow a bird knows how the fluid stands in the self-registering levelling-tubes, and adjusts itself accordingly. Observations made on pigeons show that "when the membranous canals are divided, very remarkable disturbances of equilibrium ensue, which vary in character according to the seat of the lesion. When the

horizontal canals are divided rapid movements of the head from side to side, in a horizontal plane, take place, along with oscillation of the eyeballs, and the animal tends to spin round on a vertical axis. When the posterior or inferior vertical canals are divided, the head is moved rapidly backwards and forwards, and the animal tends to execute a backward somersault, head over heels. When the superior vertical canals are divided, the head is moved rapidly forwards and backwards, and the animal tends to execute a forward somersault, heels over head. Combined section of the various canals causes the most bizarre contortions of the head and body." (Ferrier, Funct. of the Brain, 1876, p. 57.) Injury of the canals does not cause loss of hearing, nor does loss of equilibrium follow destruction of the cochlea. Two diverse though intimately connected functions are thus presided over by the acoustic nerve, — audition and equilibration.

Senses of Taste and Touch: Gustation and Taction. — The hands of birds being hidden in the feathers which envelop the whole body — their feet and lips, and usually much if not all of the tongue, being sheathed in horn, these faculties would appear to be enjoyed in but small degree. While it is difficult to judge how much appreciation of the sapid qualities of substances birds may be capable of, we must not be hasty in supposing their sense of taste to be much abrogated. One who has had the toothache, or teeth "set on edge" by acids, or painfully affected by hot or cold drinks, may judge how sensitive to impressions an extremely dense tissue can be. Persons of defective hearing may be assisted to a kind of audition by an instrument applied to the teeth; and it is not easy to define the ways in which sensory functions may be vicariously performed or replaced. Birds are circumspect and discriminative, even dainty, in their choice of food, in which they are doubtless guided to some extent by the gustatory sensations they experience. As, however, only some human beings make these an end instead of a natural and proper means to an end, the selection of food by birds may be chiefly upon intuitions of what is wholesome. Such purely gustatory sense as they possess is presided over by the branches of the *glosso-pharyngeal* nerve which go to the back part of the tongue and mouth. Though the chorda tympani nerve exists, there is no lingual (gustatory) branch of the third division of the fifth cranial nerve. Yet the latter, which goes in mammals to the anterior part of the tongue, is less effectually gustatory than the glosso-pharyngeal; as we know by the fact that the sensation of taste is not completely experienced until the sapid substance passes to the back of the mouth. Gustation is likewise connected with olfaction; the full effect of nauseous substances for example, being not realized if the nose is held. From these alternative considerations, each one may estimate for himself how much birds know of sapidity; remembering also, how soft, thick, and fleshy are the tongue and associate parts in some birds, as parrots and ducks, in comparison with birds whose mouths are quite horny.

The beak is doubtless the principal tactile instrument; nor does its hardness in most birds preclude great sensitiveness; as witness the case of the teeth, above instanced. Sensation is here governed by the branches of the fifth nerve. In some birds, in which also the terminal filaments of this nerve are largest and most numerous, the bill acquires exquisite sensibility. Such is its state in the snipe family, in most members of which, as the woodcock, true snipe, and sandpipers, the bill is a very delicate nervous probe. The *Apteryx* also feels in the mud for its food, enjoying moreover the unusual privilege of having its nose at the end of its long exploration. Ducks dabble in the water to sift out proper food between the "strainers" with which the sides of their beaks are provided; and the ends of the maxillary and mandibular bones themselves are full of holes, indicating the abundance of the nervous supply (fig. 63).

The senses of birds and other animals are commonly reckoned as five — a number which may be defensively increased — as by a sixth, the muscular sense, which gives consciousness of strain or resistance, apart from purely tactile impressions; and perhaps a seventh, the faculty of equilibration, which has a physical mechanism of its own, at least as distinct and complete as that of hearing. The ordinary "five senses" are curiously graded. *Taction* con-

notes qualities of matter in bulk, as density, roughness, temperature, etc. *Gustation*, matter dissolved in water — fluidic. *Olfaction*, matter diffused in air — aeriformed. *Audition*, atmospheric air in undulation. *Vision*, an ethereal substance in undulation. All animals are probably also susceptible of *biogenation*, which is the affection resulting from the influence of biogen; a substance consisting of self-conscious force in combination with the minimum of matter required for its manifestation.[1]

c. Myology: the Muscular System.

Muscular Tissue consists of more or fewer amœbiform animals; separate colonies of which creatures, isolated in various parts of the body, compose the individual different muscles. They are enveloped in fibrous tissue, the sheets of which are called *fasciæ*, and the ends of which, usually attached to bones by direct continuity with the periosteal covering of the latter, form tendons and ligaments. The muscle-animals belong to a genus which may be termed *Myamœba*, differing from other genera of the amœbiforms which compose the body of a bird less in their physical character of being elongated and spindle-shaped, or even filiform, than in their physiological character of *contractility*. Under appropriate stimulus, as the passage of a current of electricity, or the wave of biogen-substance which constitutes a "nerve-impulse," *Myamœbæ* shorten and thicken, tending towards a state of tonic contraction which, if completed and long sustained, would cause them to become encysted as spherical bodies; but extreme contraction is never long continued. By alternate contraction and relaxation all the motions of the body in bulk are effected. The capacity of, or tendency to, contraction is called the *tonicity* of muscular fibre. The simultaneous contraction of any colony of *Myamœbæ* pulls upon the attachment of the muscle at each of its ends; in some cases approximating both ends; oftener moving the part to which one end is attached, the other being fixed. The action of a muscle is upon the simplest mechanical principles, — nothing more or less than pulling upon a part, as by a rope, the line of traction being exactly in the line of contraction of the muscle; though it is often ingeniously changed by the passage of tendons around a corner of bone, or through a loop of fibrous tissue, as if through a pulley. Such movements as those of a turtle protruding its head, or a bird thrusting its beak forward, where muscle seems to *push*, are fallacious; when analyzed, the motion is invariably resolved into simple *pulling*. The swelling up of a muscle in contracting must indeed impinge upon neighboring parts and shove them aside; but that is an extrinsic result. Muscles contract most powerfully under resistance to their turgescence: what is effected by the fasciæ which bind them down; — what the athlete seeks to increase by bandaging his swelling *biceps*. There are two species of *Myamœba*. *M. striata* is the ordinary striped fibre of voluntary motion, and also of some motion not under control of the will, as that of the heart. This species is usually of a rich red color (pale pink in many birds of the grouse family), and is the ordinary "flesh" of the body. The other species, *M. lævis*, composes the pale or colorless smooth fibre of the involuntary muscles, as those of the intestines, the gullet, etc. A species of contractile tissue commonly referred to the genus *Desmamœba* (indifferent connective-tissue cells) is very near *Myamœba lævis*; example, mammalian *dartos*. The movements of erectile organs, as the neat combs over the eyes of grouse, or the turkey's caruncles, are not in any sense *myamœbic*, but depend mechanically upon influx of blood.

The Muscular System of Aves can only be touched upon; it is impossible in my limits to even name all the muscles, much less describe them. I can only note the leading peculiarities, and present a figure in which the principal muscles are named.

[1] The reader who may be interested to inquire further in this direction is referred to a publication entitled: — Biogen: A Speculation on the Origin and Nature of Life. Abridged from a paper on the "Possibilities of Protoplasm," read before the Philosophical Society of Washington, May 6, 1882. By Dr. Elliott Coues, etc. Washington, Judd & Detweiler. 8vo, pp. 27. Second ed., Boston, Estes & Lauriat, 1884.

The subcutaneous sheet of muscle (of which the human "muscles of expression" and *platysma myoides* are segregations) is broken up in birds into a countless number of little slips which agitate the feathers collectively, and especially the great quills of the wings and tail. There are estimated to be 12,000 in a goose. The prime peculiarity of birds' musculation is the enormous development of the *pectorales*, or breast muscles, which operate the wings. The great pectoral, *p. major* or *p. primus*, arises from the sternal keel, when that special bony septum between the fellow-pectorals exists, and from more or less of the body of the sternum, passing directly to the great pectoral or outer ridge of the humerus, near the upper end of that bone. Its origin may even exceed the limits of the sternum, invading the clavicle, etc.; it may unite with its fellow. It is the depressor of the humerus, giving the *downward* stroke of the wing. The next pectoral, *p. secundus* or *p. medius*, arises from much or most of the sternum not occupied by the first, under cover of which it lies; it passes also the humerus, but by an interesting way it has of running through a pulley at the shoulder it elevates that bone, giving the *upward* wing-stroke. A third pectoral, *p. tertius* or *p. minimus*, arising from sternum, and often contiguous parts of the coracoid bone, passes directly to the humerus, supplementing the action of the first. A fourth muscle in many birds acts upon the humerus from the sternum or coracoid, particularly the latter. These four differ greatly in their relative development. Such extent of the sternum and pectoral muscles correspondingly reduces that of the belly-walls, and the abdominal muscles are consequently scanty. Fixity of the spinal column in the dorsal region diminishes the musculation of that part, the spinal muscles being much better developed in the cervical region; where, in cases of some of the long-necked birds, there are curious contrivances for the mechanical advantage of the muscle in flexing and extending this mobile part of the body. Muscles of the hyoidean apparatus acquire a singular development in woodpeckers. The lower jaw is depressed particularly by muscle inserted into the end of the mandible; the upper is elevated by particular muscles operating the pterygoid and quadrate bones. Temporal, masseteric, and ordinary pterygoid muscles close the jaws. They are unsymmetrical in *Loxia*.

The *diaphragm*, the musculo-membranous partition which in mammals divides the thoracic from the abdominal cavity, is only represented in birds in a rudimentary condition. Macgillivray has figured that of the rook as consisting of three fleshy slips, *v*, *v*, *v*, passing from as many ribs, 4, 5, 6, to the pleural sac of the lungs, *t*, *t*, in fig. 101, p. 206. It is best developed in the *Apteryx*.

The remarkable specialization of both limbs, — the former for flight, the latter for the perfectly bipedal locomotion which only birds besides man enjoy, — results in corresponding peculiarities of the muscular mechanism. Muscles beyond the shoulder are greatly reduced in number and complexity from an ordinary quadrupedal standard; those of the legs are rather increased, and their configuration, relative size, and to some extent their relations are so much changed, that great difficulty is experienced in identifying them with the corresponding muscles of quadrupeds. The result is, great confusion in their nomenclature, which is still shifting, though much has been done of late to give it precision. Attention has recently been called by Garrod to the classificatory value of certain muscles of the limbs. The *tensor patagii*, that muscle or muscles which may have elastic tendons, and by which the folds of skin in the angles of the wing bones are regulated, may have different characters in different groups of birds. It has long been known that particular muscles of the hind limb are in direct and important relation to the prehensile power of the toes, and consequently co-ordinated with the insessorial or the reverse character of the foot. In the highest birds, *Passeres*, the foot grasps with great facility, owing to the distinctness or individuality of the *flexor longus hallucis*, or bender of the hind toe. The *ambiens* (Lat. *ambiens*, going around) is a muscle of which Garrod has even made so much as to divide all birds into two primary groups according to whether they possess it or not. The ambiens arises from the pelvis about the acetabulum, and passes along the inner side of the thigh; its tendon runs over the *convexity* of the knee to the outer side, and ends by

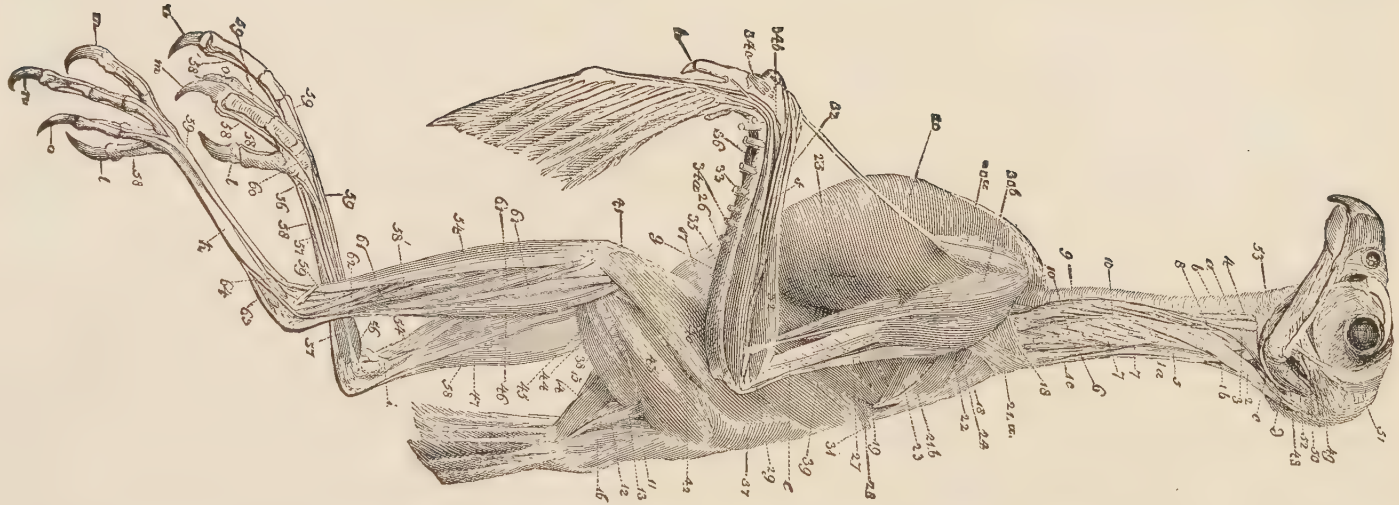


FIG. 89. — Muscles of a bird (*Accipiter nisus*), after Carus, *Tab. Anat. Comp.*, i, 1828, pl. 4. *a*, pharynx ; *b*, trachea; *c*, hyoid bone; *d*, ear ; *e*, humerus; *f*, radius; *g*, ulna; *h*, radial finger; *i*, tibia; *k*, metatarsus; *l*, hind toe ; *m*, inner toe; *n*, middle toe; *o*, outer toe. 1, biventer cervicis, with central tendon 1 *a*, and upper 1 *b*, and lower 1 *c*, belly. 2, complexus. 3, flexor capitis lateralis. 4, flexor longus capitis. 5, extensor magnus cervicis. 6, descendens cervicis. 7, 7, semispinales. 8, flexor superior capitis. 9, flexor inferior or longus capitis. 10, 10, intertransversales. 11, levator coccygis. 12, depressor coccygis. 13, cruro-coccygeus (ilio-coccygeus?). 14, pubo-coccygeus. 15, ischio-coccygeus. 16, lateralis quartus (quadratus coccygis, to tail-feathers). 17, obliquus externus abdominis. 18, cucullaris (trapezius). 19, serratus magnus. 20, pectoralis major. 21, *a*, *b*, latissimus dorsi. 22, deltoid. 23, suprascapular. 24, coraco-brachialis. 25, biceps brachii. 26, supinator longus. 27, anconeus longus (part of "triceps"). 28, anconeus brevis. 29, anconeus brevissimus. 30 *a*, 30 *b*, tensor patagii, carpal and radial parts. 31, tensor patagii posterior 32, extensor metacarpi longus. 33, extensor metacarpi brevis. 34 *a*, flexor digitorum sublimis. 34 *b*, flexor digitorum profundus. 34 *c*, flexor brevis pollicis. 35, flexor metacarpi radialis. 36, flexor (meta-) carpi ulnaris. 37, glutæus maximus. 38, adductor femoris primus. 39, sartorius 40, latissimus femoris. 41, gracilis = *ambiens:* only its tendon in sight. 42, vastus; 43, biceps cruris. 44, semimembranosus. 45, semitendinosus. 46, 46, 47, gastrocnemius. 48, digastricus (chief opener of the mouth). 49, temporal. 50, long ligament. 51, cutaneous muscle of scalp. 52, masseter. 53, a muscle of the hyoid bone. 54, tibialis anticus. 55, tibialis posticus. 56, extensor hallucis. 57, flexor hallucis. 58, flexor digitorum profundus or perforans, seen in various places: long and short head, and several tendons. 59, extensor longus digitorum, tendons seen in various places. 60, abductor digiti interni. 61, 61, 61, flexores digitorum perforati. 62, peronæus. 63, abductor minimi digiti. 64, abductor hallucis.

connecting with the *flexor digitorum perforatus*, — one of the muscles which bend the toes collectively. When this arrangement obtains, the result is that when a bird goes to roost, and squats on its perch, the toes automatically clasp the perch by the strain upon the ambiens that ensues as soon as the leg is bent upon the thigh, and the tarsus upon the leg, the weight of the bird thus holding it fast upon its perch. The effect is as if an elastic cord were tied to the hip joint, thence directed over the front of the knee and back of the heel and so on to the ends of the toes. Obviously, such a cord would be strained when the limb is bent, relaxed when the limb is straightened out. The reader may observe a corresponding effect of the muscular arrangement of his forearm by throwing the hand as far back as possible; the fingers tend to close by the strain on the flexors in passing over what is a convexity of the wrist when the hand is in that position. *Passeres* have no ambiens, the perfection of their feet in other respects answering all purposes. Birds having it are termed *homalogonatous* or "normally-kneed" (Gr. ὁμαλός, *homalos*, from ὁμός, *homos*, like, even, etc.; γόνυ, γόνατος, *gonu, gonatos*, knee); those wanting it are called *anomalogonatous*, "abnormally-kneed." The distinction prevails with much applicability to various large groups of birds, and does good duty in diagnosis when duly connected with other characters; but surely should not give name to primary groups founded upon it! Other muscles of the leg much used by the same sagacious and zealous anatomist are the *femoro-caudal*, *accessory femoro-caudal*, *semitendinosus*, and *accessory semitendinosus*. The whole five of these muscles "vary; any one or more than one may be absent in different birds; . . . the constancy of the peculiarities in the different individuals of each species, or the species of each genus, and very generally in the genera of each family, makes it evident to any one working at the subject that much respecting the affinities of the different families of birds is to be learnt from the study of their myology, in connection with the peculiarities of their other soft parts; and that these features will, in the long run, lead to a more correct classification than one based on the skeleton alone, becomes almost equally certain." (Garrod, *P. Z. S.*, 1873, p. 630.) I quote in justice of this author, a modern Macgillivray in sincerity and love of truth; and very generally, in constructing my characters of the higher groups of birds in the body of this work, I shall be as glad to use the myological formulæ of Garrod, as I am here to pay this slight tribute to his memory.

d. Angeiology: the Vascular or Circulatory Systems.

Blood and Lymph are the two media by the circulation of which throughout the body the various amœboid animals which compose the tissues are fed, their waste repaired, and their dead parts removed. Each species of *Amœba* has the faculty of selecting from the constituents of blood and lymph its appropriate food; and of converting such nourishment into its own proper substance. Refuse matters are either drained off by the kidneys and voided as excrement, or swept by the current of blood into the lungs and there cremated. The stream of lymph is a feeder to the blood, and when the mingled currents are no longer distinguishable has become blood. The machinery of circulation is two sets of vessels — the *hæmatic*, or vascular system proper, consisting of the heart, arteries, veins and capillaries for the blood-circulation; and the *lymphatic*, consisting of lymph-hearts and vessels, for the flow of lymph. The lymphatics, converging from all parts of the body, and especially from the intestines, end in vessels which pour the lymph into the veins of the neck. The heart is the central organ of the blood-circulation, by which that fluid is pumped into all parts of the body through the *arteries* or *efferent* vessels; straining through the network of *capillaries*, it returns to the heart through the *veins*, or *afferent* vessels. The set of efferent vessels is the *arterial system*; that of afferent vessels is the *venous system*. The blood in arteries excepting the *pulmonary* is bright red; that in veins excepting the pulmonary is dark red. The change from bright to dark occurs in the capillaries of the system at large; the change from dark to bright only in the capillaries of the lungs and air-sacs. The *systemic* blood circulation is completely separated from the *pulmonic*

in all animals in which, as in birds, the right and left sides of the heart are separated from each other; such circulation is said to be *double;* that is, arterial and venous blood only mingle in the capillaries, whether of the lungs or others, and therefore at the *periphery* of the vascular system: the heart being the centre of that system. Blood, in all or some of its constituents, permeates absolutely every tissue of the body. Those tissues whose capillaries are large enough for the passage of all the constituents of blood are said to be *vascular;* those which only feed by sucking up certain constituents of the blood, and have no demonstrable capillaries, are called *non-vascular.* But nutrient fluid penetrates the densest tissue, as the dentine of teeth; no permanent tissues are really non-vascular, or they would soon die, as do feathers, which require to be renewed once a year or oftener.

Lymph and the lymphatics are noticed further on. Blood consists of water in which several ingredients are dissolved, and certain solid bodies are suspended. Its water is salted, albuminated, fibrinated, and corpusculated. The proportions, which vary in different birds and at different times in the same bird, are in round numbers: water 80, fibrine and corpuscles 15, albumen and salts 5 = 100 parts. Withdrawn from the body and allowed to settle, blood separates into two parts, *serum* and *coagulum.* The serum is the clear yellowish salty albuminous water; the clot is the fibrine, in the meshes of which are mired the corpuscles, reddening the whole mass. The *plasma*, plasm or plastic material of the blood, is its substance dissolved in water; that is to say, *minus* the solid corpuscles. These latter interesting little bodies are a myriad of minute animals, which swim in the life-current, and are named *Hæmatamœba cruentata.* They have been supposed to be of two species; but the so-called white blood corpuscles, or *leucocytes*, indistinguishable from lymph corpuscles, are simply the formative stages of the red blood-discs. In its early colorless stage, the *Hæmatamœba* is a nucleated mass of protoplasm (*protoplasm* is the indifferent substance out of which all animal tissue is derived), of no determinate size or shape, exhibiting active amœboid movements. Later in the life of the minute creature, it passes into a sort of encysted state, in which it reddens and acquires definite dimensions and configuration. In birds, these "blood-discs" are flat, elliptical, and *nucleated*, that is, containing a kernel: they average in the long diameter $\frac{1}{2100}$, in the short $\frac{1}{3800}$, of an inch. Thus they differ decidedly from the flat, circular, non-nucleated, red blood-discs of *Mammalia*, which latter are supposed to be rather *free nuclei* than perfected *Hæmatamœbæ.* The red color of blood is entirely due to the presence of these unicellular animals. The energy of respiration, and corresponding activity of circulation in birds, make them *hæmatothermal*, or hot-blooded; the pulse is quickest, the blood hottest, and richest in organic matter, in these of all animals.

The Heart is a hollow muscular organ, at the physiological centre of the hæmatic vascular system. Its muscle presents the principal exception to the rule, that the contractility of *Myamœba striata* (see p. 192) is subject to voluntary control. It is the most industrious organ of the body, never ceasing its rhythmic *systole* and *diastole*, or contraction and dilatation, from the moment of the first pulsation in the contractile vesicle which begins it, to that when the "muffled drum" gives the last beat of the "funeral march to the grave." The arteries are the elastic thick-walled branching tubes which leave the heart on their way to the body at large; their pulsations, over which the vaso-motor nervous system presides, are isochronous with the heart-beats, and arterial blood thus flows in jets. The veins are the vessels converging from all parts; thin-walled, less elastic, with more equable current. The capillaries are the communicating vessels, of such size as just to permit the Hæmatamœbas to pass through; their network represents the terminations of arteries and the commencements of veins. The heart in adult birds is completely double; *i. e.*, the right and left sides are perfectly separated. It is also completely four-chambered; *i. e.*, there is an *auricle* and a *ventricle* on each side, which communicate; in embryonic life the two auricles communicate by the *foramen ovale*,

which then closes. Arteries proceed from the strong muscular ventricles; veins are received by the weaker auricles. The course of the blood is: From the body excepting the lungs it comes, dark and heavy with products of decomposition, through the *caval* veins into the *right auricle;* from right auricle through the auriculo-ventricular opening into *right ventricle;* from right ventricle through the *pulmonary arteries* to the lungs; in the capillaries of which it is relieved of its burden. There decarbonized and oxygenized, the bright red aerated blood returns through the *pulmonary veins* to the *left auricle;* through the corresponding auriculo-ventricular opening to the *left ventricle,* which pumps it out through the *aorta* and other arteries to the capillaries, and so to the veins and heart again. Thus the pulmonary *arteries* convey black blood, the pulmonary *veins* red blood; the reverse of the usual course. Before lungs come into play, in the egg, the blood is purified in the *allantois,* an embryonic organ which then sustains a respiratory function. Besides the pulmonary there is another special circulatory arrangement, the *hepatic portal* system of veins, by which blood coming from the *chylopoetic* viscera (stomach, intestines, etc., which make chyle in the process of digestion), strains through the liver before reaching the heart. There is no *renal* portal system in birds.

The heart of birds is not peculiar in its conical shape, but is more median in position than in mammals. There being no completed diaphragm, the pericardial sac which holds it is received in a recess between lobes of the liver. The right ventricle is much thinner-walled than the left; the auricles have less of the elongation which has caused their name ("little ears" of the heart) in mammals. The *right* auriculo-ventricular valve, which prevents regurgitation of blood, instead of being thin and membranous, is a thick fleshy flap which during the ventricular systole applies itself closely to the walls of the cavity. The pulmonary artery and the aorta are each provided at their origination with the ordinary *three* crescentic or "semilunar" valves, as in mammals. The pulmonary artery arises single, forking for each lung. The pulmonary veins are *two.* The systemic veins, or *venæ cavæ,* bringing blood from the body at large, are *three* — two *pre-caval,* from head and upper extremities, one *post-caval,* from trunk and lower extremities. The *aorta,* almost immediately at the root of that great trunk, figs. 90–95, *h,* divides into three primary branches; right, *ri,* and left, *li, innominate* arteries, conveying blood to the neck, head and upper extremities; and main *aortic, a,* which curves over to the *right* (left in mammals) and supplies the rest of the body. More precise statement is, perhaps, that the aortic root, *h,* first gives off the left innominate, *li,* then at once divides into right innominate, *ri,* and main aortic trunk, *a,* (right). It represents the *fourth* primitive aortic arch of the embryo. On the whole, the avian heart is a great improvement on that of most reptiles, though nearly resembling that of *Crocodilia;* it is substantially as in any mammal, though differing in its fleshy right auriculo-ventricular valve, two instead of one pre-caval vein, right instead of left aortic arch, and mode of origin of the primary aortic branches.

The zoölogical interest of the avian blood-vessels centres in the *carotid arteries,* which, with the *vertebral* arteries, supply the neck and head. The carotids may be single or double; and other details of their disposition correspond well with certain families and orders of birds. They are the first branches of the innominates. In most birds, there is but one carotid, the left; in a few, one, formed by early union of two; in many, two, long distinct. The arrangement will be perceived by the diagrams taken from Garrod's admirable paper (*P. Z. S.,* 1873, p. 457). In nearly the words of this author: 1. In what may be termed the *typical* arrangement (though it is not the usual one), two carotids, of equal size or nearly so, run up the front of the neck, converging till they meet in the middle line, and so continue up to the head, on the front of the bodies of the cervical vertebræ, in the hypapophysial canal. Birds with this arrangement Garrod calls *aves bicarotidinæ normales* (fig. 90). 2. In most birds, the carotid branch of the right innominate being not developed, only the *left,* of larger size, traverses the hypapophysial canal; but it bifurcates before reaching the head, thus producing two carotids, distributed as if there had been two all the way up. Such birds are said to have a left carotid,

and are termed *aves lævo-carotidinæ* (fig. 91). 3. In certain parrots only, with two carotids, the right is as in (1), but the left runs superficially along the neck with the jugular vein and pneumogastric nerve; such birds are *aves bicarotidinæ abnormales* (fig. 92). 4. Two carotids, arising normally, unite almost immediately, and the single trunk runs to near the head, just as if there were two as in (1); then it bifurcates, as in birds with left carotid only (2). Such birds are termed *aves conjuncto-carotidinæ*. Special cases of (4) are: in the bittern, the two roots are of nearly equal size (fig. 93); in the flamingo, the left is very small (fig. 94); in a cockatoo, the right is very small (fig. 95). Parrots display all four of the arrangements; the cases of the bittern and flamingo are unique. The question is thus for nearly all birds narrowed to whether there be two normal carotids (1), or the left only (2). Observations upon three hundred genera show two in one hundred and ninety-three, in one hundred and seven the left only; but the

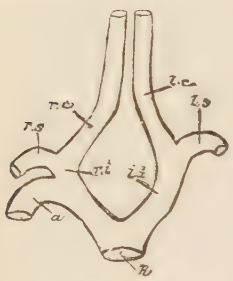


FIG. 90.

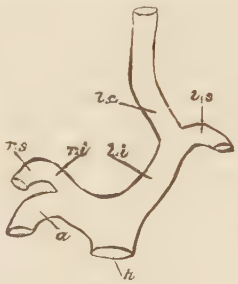


FIG. 91.

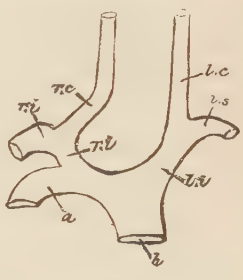


FIG. 92.

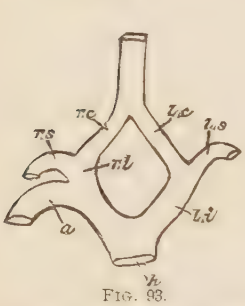


FIG. 93.

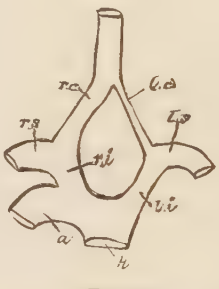


FIG. 94.

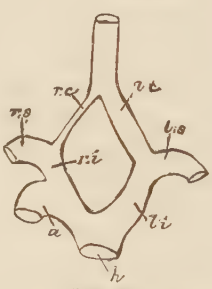


FIG. 95.

FIGS. 90–95. — Diagrams of carotid arteries of birds: *h*, root of aorta; *a*, arch of aorta, to the right side; *li*, left innominate; *ri*, right innominate; *ls*, left subclavian; *rs*, right subclavian; *lc*, left carotid; *rc*, right carotid. (1) Fig 90. *Aves bicarotidinæ normales*, with two carotids, both alike. (2) Fig. 91. *Aves lævo-carotidinæ*, with left carotid only. (3) Fig. 92. *Aves bicarotidinæ abnormales*, certain parrots, with two carotids, not alike. (4, 5, 6) *Aves conjuncto-carotidinæ*, with two carotids, which speedily unite in one. (4) Fig. 93, bittern, both alike. (5) Fig. 94, flamingo, left very small. (6) Fig. 95, cockatoo, right very small. (Copied by Shufeldt from Garrod.)

numerical proportion of *Passerine* genera makes (2) the most frequent arrangement. There is but one carotid in all *Passeres* as far as known; in most *Cypselidæ;* in *Trogonidæ*, *Meropidæ*, *Upupidæ*, *Rhamphastidæ*, some *Psittaci*, the *Turnicidæ*, *Megapodidæ*, *Podicipedidæ*, *Alcidæ*, *Rheidæ*, *Apterygidæ*. Thus in *Passeres*, *Columbæ*, *Accipitres*, *Grallæ*, and *Anseres*, the carotid arrangement is an *ordinal* character, all but the first named of these great groups having two. The character separates most of the *families* of "Picarian" birds, and also distinguishes the families *Phœnicopteridæ*, *Megapodidæ*, *Cracidæ*, *Turnicidæ*, *Podicipedidæ*, and family groups of the *Ratitæ*, from among one another. It is apparently only a generic character in *Psittaci*, and in *Cypselidæ*, *Ardeidæ* and *Alcidæ*.

Reaching the skull, the carotids burrow in the bone, between the basitemporal plate and the true floor of the skull, and enter the cranial cavity by the "sella turcica" (the original pituitary space): their anastomosis furnishes a sort of "circle of Willis." (Figs. 66, 69, 70, *ic.*)

Both limbs of birds have a prime peculiarity of their arteries as compared with mammals. In the fore limb, the blood supply being chiefly absorbed by the immense pectoral muscles, vessels which in mammals are small *axillary* branches appear like the main continuation of the *subclavian* trunk, and the brachial arteries are correspondingly reduced. In the leg, the main source of supply is the great *ischiac* artery, the femoral being small. This ischiac artery corresponds to the twig which in man accompanies the great sciatic nerve (*comes nervi ischiatici*); and the rare human anomaly of a *posterior* main vessel of the thigh is therefore a reversion (atavism) to the avian rule. There is no single proper *renal* artery to the kidney.

The Lymphatics of birds consist chiefly of a deep set accompanying the main blood-vessels, forming various *plexus*, — nodes, "glands," or "lymph-hearts" in their course. Superficial lymphatics, so prominent in mammals, are little developed, though lymphatic glands are found in the arm-pit and groin of some birds. These are the *systemic* vessels; a special set, the *lacteals*, arise by numberless twigs in the course of the small intestine, uniting and reuniting to form at length *two* (not one as in mammals) main tubes, which lie along either side of the spinal column. These are the *thoracic ducts;* which terminal trunks of the whole lymphatic system empty into the right and left *jugular* veins at the root of the neck. The contents of the vessels differ correspondingly. Pure lymph is a pale, limpid, albuminous fluid, containing when maturely elaborated a number of irregular amœboid bodies, indistinguishable from the white formative corpuscles of the blood (p. 196). It is strained out of the tissues at large, being that material, not yet effete, which is still fit for feeding the blood. The lacteals contain *chyle*, — the other kind of lymph, drained off by the mucous membrane of the intestine from the prepared food in that tube; an albuminous fluid, milky or cloudy from the abundance of oil-globules, which, after mingling with the systemic lymph, is poured directly into the current of the blood, in the manner above said. Since the lacteals do not appear to begin with open mouths, the chyle must soak into them through the lining membrane of the intestines; and as this consists of a layer of amœba-like animals, through whose bodies the chyle passes, it is quite true to say that the whole organism is nourished upon the excrement of amœbas.

e. Pneumatology: the Respiratory System.

The Organs of Respiration provide for the ventilation of the body. Since the respiratory process is also calorific, they likewise furnish a heating apparatus. They consist essentially of air-passages and air-spaces connected with lung-tissue, being therefore *pulmonary* organs. No other animals are so thoroughly permeated as birds with the atmospheric medium in which they live; in no others are the respiratory functions so energetic and effectual. The lung may be likened to a blast-furnace for the combustion of decayed animal matter; purification of the blood and warming of the body being two inseparable results obtained. Dark blood flowing to the lungs, heavy with effete carbonaceous matters, is there relieved of its burden and aërated by the action of oxygen; the products of combustion being exhaled in the form of carbonic dioxide and water. Aside from the proper lung-tissue, the capillary substance of the immense air-sacs tends to the same result. There is likewise, in birds, a lesser system of ventilation, by which air is admitted to cranial bones through the eustachian tubes; but this is unconnected with the proper respiratory office. Pulmonary tissue consists chiefly of a wonderful net (a *rete mirabile*) of capillaries, interlacing in every direction, bound together and supported by fine connective tissue, and invested with membrane so delicate that their walls seem naked, their exposure to the air being thus very thorough. Air gains such intimacy with the capillaries through the *larynx*, *trachea* (fig. 101, *o*), and *bronchial tubes* (*r*, *r*), these being the primary air-passages. But all the bronchial tubes do not subdivide into the ultimate air-cells; some large ones run through the lung, pierce its surface (as at *u*, *u*, fig. 101), and end

in that system of enormous air-spaces for which the respiratory system of birds is so remarkably distinguished, — like a heap of soap-bubbles, blown up *en masse* from a bowl of fluid; the extra-pulmonary air-spaces being the larger superficial bubbles, the minute vesicles of lung-tissue proper being little bubbles just formed. In this way air penetrates even the hollow skeleton of most birds (p. 135).

The Lungs of Birds (fig. 101, *t, t*), notwithstanding their heated energy of respiration, are anatomically more like those of reptiles than of mammals. They are not shut by a diaphragm in a special division of the great thoracic-abdominal cavity of the body, but extend from the apex of the chest as far as the kidneys, in the pelvic region. They are not divided into lobes, as in mammals, nor do they as in that class float freely in the chest by their mooring at their roots; nor, again, are they completely invested by a serous membrane forming a closed pleural cavity. They are fixed in the dorsal region of the general cavity, covered in front with pleura, with which slips of the rudimentary diaphragm (*r, r, r*) are connected; but on the dorsal surface are accurately moulded to the intercostal spaces, showing the impressions of the ribs and vertebræ, — just as the lobulated kidneys are stamped with the sacral inequalities of surface. They are, as usual, two, right and left; their "roots" are the bronchi (*r, r*), the pulmonary arteries and veins, nerves, and connective tissue.

The Pneumatocysts. — A bird is literally inflated with these great membranous receptacles of air, and draws a remarkably "long breath," — all through the trunk of the body, in several pretty definite compartments; in many, or most, or all, of the bones: in many intermuscular spaces; in some birds also throughout the cellular tissue immediately beneath the skin. They vary so much in extent and disposition as to be not easily described except either in the most general terms already used, or with particularity of detail for different species. According to Owen, however, the usual disposition is: An *inter-clavicular* air-space, quite constant: this, with its *cervical* prolongations, furnishes the great "air-drums" of our pinnated grouse and cock-of-the-plains. *Anterior thoracic*, about the roots of the lungs. *Lateral thoracic*, prolonged to *axillary*, and to spaces and passages in the wings, including the hollow humerus. Large *hepatic* or *posterior thoracic*, about the lower part of the lung and the liver. *Abdominal*, right and left, of great size, from the lower part of the lung where the longest bronchial tubes open very freely; extending to *pelvic* and *inguinal* compartments, whence *femoral* sacs, the hollow of the femur, etc. The *subcutaneous* cells are enormously developed in the pelican and gannet; the extensive areolar tissue being thoroughly pneumatic, and furnished with an arrangement of the cutaneous muscle (*panniculus carnosus*) whereby, apparently, the air may be rapidly and forcibly expelled by compression. A similar muscle develops in some birds in connection with the interclavicular air-space. (For pneumaticity of the skeleton, see p. 135.)

The purpose of this extensive respiratory apparatus is thus dwelt upon by the great "Newton of Anatomy" just cited: "The extension from the lungs of continuous air-receptacles throughout the body is subservient to the function of respiration, not only by a change in the blood of the pulmonary circulation effected by the air of the receptacles on its repassage through the bronchial tubes; but also, and more especially, by the change which the blood undergoes in the capillaries of the systemic circulation which are in contact with the air-receptacles. The free outlet to the air by the bronchial tubes does not, therefore, afford an argument against the use of the air-cells as subsidiary respiratory organs, but rather supports that opinion, since the inlet of atmospheric oxygenated air to be diffused over the body must be equally free. A second use may be ascribed to the air-cells as aiding mechanically the action of respiration in birds. During the act of inspiration the sternum is depressed [lowered from the back-bone in horizontal position of a bird], the angle between the vertebral and sternal ribs made less acute,

and the thoracic cavity proportionally enlarged; the air then rushes into the lungs and thoracic receptacles, while those of the abdomen become flaccid; when the sternum is raised or approximated towards the spine, part of the air is expelled from the lungs and thoracic cells through the trachea, and part driven into the abdominal receptacles, which are thus alternately enlarged and diminished with those of the thorax. Hence the lungs, notwithstanding their fixed condition, are subject to due compression through the medium of the contiguous air-receptacles, and are affected equally and regularly by every motion of the sternum and ribs. A third use, and perhaps the one which is most closely related to the peculiar exigencies of the bird, is that of rendering the whole body specifically lighter: this must necessarily follow from the desiccation of the marrow and other fluids in those spaces which are occupied by the air-cells, and by the rarification of the contained air from the heat of the body. . . . A fourth use of the air-receptacles relates to the mechanical assistance which they afford to the muscles of the wings. This was suggested by observing that an inflation of the air-cells in the gigantic crane (*Ciconia argala*) was followed by an extension of the wings, as the air found its way along the brachial and anti-brachial cells. In large birds, therefore, which, like the argala [or our wood ibis, *Tantalus loculator*], hover with a sailing motion for a long-continued period in the upper regions of the air, the muscular exertion of keeping the wings outstretched will be lessened by the tendency of the distended air-cells to maintain that condition. It is not meant to advance this as other than a secondary and probably partial service of the air-cells. In the same light may be regarded the use assigned to them by Hunter, of contributing to sustain the song of birds and to impart to it tone and strength. It is no argument against this function that the air-cells exist in birds which are not provided with the mechanism necessary to produce tuneful notes; since it was not pretended that this was the exclusive and only office of the air-cells." (Owen, *Anat. Vert.*, ii, 1866, p. 216.)

Though nothing like them exists in mammals, it must not be inferred that these air-pouches are unique in birds. The general pulmonary mechanism is reptile-like, and the ornithic development is simply a logical extreme of arrangements found in reptiles and lower vertebrates, — even to the swim-bladder of a fish, which is morphologically and homologically pulmonary, though fishes' *gills* are functionally, and therefore analogically, their lungs; *i. e.*, their respiratory apparatus.

The Trachea (Gr. τραχεῖα, *tracheia*, rough) or "asper-artery" answers perfectly to its English name, wind-pipe. It is the tube which conveys air to and from the lungs (fig. 101, 1, *o* to *q*). It commences at the root of the tongue by a chink in the floor of the mouth (fig. 101, 3, *c*), runs down the neck in front between the gullet and the skin, and ends below by forking into right and left *bronchus* (fig. 101, 1, *r*, *r*). It is composed of a series of very numerous gristly or bony rings connected together by elastic membrane. Lengthening and shortening, effected by muscles to be presently noted, is permitted by a very ingenious and interesting construction of these rings, which will be clearly understood with the help of the figures (96, *a*, *b*, 97 1, 2) borrowed from Macgillivray's admirable account. When contracted, the rings look like an alternating series of lateral half-hoops, as in fig. 96, *a*; when stretched to the utmost, as in fig. 96, *b* they are clearly seen to be annular, or completely circular. The curious bevelling of the right and left sides of each ring alternately is shown in fig. 97, 1, 2; and fig. 97, 1, 2, represents the same two rings put together. The principle by which any two rings slip

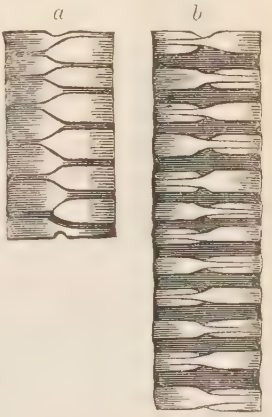


FIG. 96.—*a*, an inch of trachea, contracted to the utmost, the rings looking like alternating half-rings; *b*, the same, stretched to two inches, the rings evidently complete, with intervening membrane (After Macgillivray.)

partly over each other on alternate sides is something like that upon which a cooper fastens the ends of any one barrel-hoop without any nailing or tying. The rings are in some birds perfectly cartilaginous: in most they become osseous. The trachea is moved by lateral muscles, which not only shorten the tube by approximating the rings, but also drag the whole structure backward, by their attachment to the clavicle and sternum. The strip, or two strips, of muscle lying upon each side of the trachea, is the *contractor tracheæ* (fig. 101, [1], *ss*, *ss*); the most anterior, when there are two, as soon as it leaves the tube to go to the clavicle, becomes the *cleido-trachealis*, or *cleido-hyoid*, fig. 101, [1], *f*, *f*; the other is similarly the *sterno-trachealis*. The latter may be a direct continuation of the contractor, as in fig. 101, [1], the loose strips under *q*, or apparently arise separately from the side of the lower end of the tube, as in fig. 101, [16], *e*. (Other muscles are to be described with the larynx superior and inferior.) The trachea is long in birds, proportionate to the extension of the neck; it is very flexuous, following with ease the bends of the neck in which it lies so loosely. Its cross section is oval or circular; but all that relates to the configuration and course of the pipe requires special description, — so variable is the organ in different birds. It is subject to dilatations and contractions in any part of its extent, and to deviations from its usual direct course to the lungs. Minor modifications must be passed over. The most remarkable expansions of the lower part of the tube occur in many sea-ducks and mergansers (*Fuligulinæ* and *Merginæ*), and some other birds; several lower rings of the trachea being enormously enlarged and welded together into a great bony and membranous box, of wholly irregular, unsymmetrical contour. Such a structure, represented in figs. 3 and 98, is termed a *tracheal tympanum*, or *labyrinth*. It is not a part of the voice-organ proper, but may act as a reverberatory chamber to increase the volume of the sound, without however modulating it. Being chiefly developed in the male, it is a kind of secondary sexual organ. The vagaries of the wind-pipe are still more remarkable. Very generally, in cranes and swans, the trachea enters the keel of the sternum, which is excavated to receive it, and where it forms one or more coils before emerging to pass to the lungs. This curious winding is carried to an extreme in our *Grus americana*, the whooping crane, in which the wind-pipe is about as long as the whole bird, and about half of it — over two feet of it! — is coiled away in the breast-bone (fig. 99). The same thing occurs in *G. canadensis* to a less extent (fig. 100). In a Guinea-fowl, *Guttera cristata*, a loop of the trachea is received in a cup formed by the apex of the clavicles. In various birds, as some of the curassows (*Cracidæ*), the capercaillie (*Tetrao urogallus*), a goose, *Anseranas semipalmata*, and the female of the curious snipe, *Rhynchæa australis*, the trachea folds between the pectoral muscles and the skin.

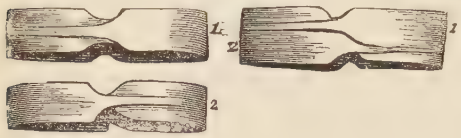


Fig. 97. — 1, 2, left hand, two tracheal rings, separate, as in fig. 96, *b*; 1, 2, right hand, the same put together, as in fig. 96, *a*. (After Macgillivray.)

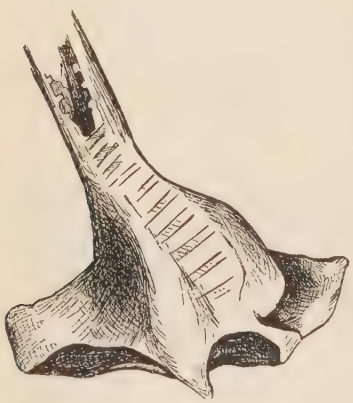


Fig. 98. — Bony labyrinth at the bottom of the trachea of the male of *Clangula islandica*, seen from behind, nat. size. Dr. R. W. Shufeldt, U. S. A.

The Larynx (the Gr. name, λάρυγξ, *larugx*) is the peculiarly modified upper end of the trachea (fig. 101, [1], and [3] to [12]). In mammals it is a complicated voice-organ, containing the vocal chords and other consonantal apparatus; in birds the construction is simpler, as the larynx merely modulates the sound already produced in the lower end of the tube. It lies in

FIG. 99. — Coiling of the windpipe in the sternum of *Grus americana;* reduced. (From Amer. Nat.)

FIG. 100. — Coiling of the windpipe in the sternum of *Grus canadensis;* reduced. (From Amer. Nat.)

the floor of the mouth, at the root of the tongue, between the forks of the hyoid bone, resting upon the uro-hyal. Besides its attachments of mucous and other membrane, it is connected with the hyoid bone by a pair of *thyro-hyoid* muscles (8, 1,1), and usually with the rest of the trachea by prolongations of the sterno- and cleido-tracheales. It is usually a small, simple, conical "mouth-piece" of the pipe (4, *a*), without the dilatation which renders the corresponding structure — the "Adam's apple," — so conspicuous in the human throat. Below, it communicates directly with the pipe: above, it opens into the mouth by the *glottidean fissure*, or *rima glottidis* (3, *c*), a median lengthwise chink, which opens and shuts as its sides diverge or close together, and which is further defended in front by a folding of the mucous membrane of the mouth, constituting a rudiment of that curious trap-door arrangement which, when fully developed, is called the *epiglottis* (3, *d*, *e*). Exclusive of two *broken* upper rings of the trachea (6, *g*), the cartilages (or oftener bones, — for they generally ossify) of the larynx are five. One is a large single median and inferior piece, the *thyroid*, or shield-piece (4, 6, 7, *a*), forming the most substantial part of the structure. It is somewhat triangular or oblong, running to an obtuse end in front; and with sides and posterior angles which curl upward behind. To its lateral posterior corner is attached on each side the small "horns" or *cornicula laryngis* (5, 6, 7, *b*). There is a small median upper posterior piece, supposed to represent all there is of the *cricoid* (5, 7, *c*), which in man makes a ring around the larynx below the thyroid. To the cricoid, as to a base, are attached a pair of straight slender *arytenoids* (6, 7, *d*), projecting forward along the upper surface of the larynx: these form the *rima glottidis*, — the fissure of the glottis being between them. The arytenoids are attached in front by slender ligaments to the end of the thyroid (5, the little slips between *d* and *e*), and they are supplemented by cartilaginous edges (6, *f*, *f*); but there are no true vocal chords. Besides the extrinsic thyro-hyoid muscles, which pass from the larynx to the tongue-bone, the laryngeal parts are operated by intrinsic muscles, the sum of the motion given by which is the opening and shutting of the glottis by drawing apart or pulling together the arytenoids. Four pairs of such muscles are described for some birds. As named and figured by Macgillivray for the rook, there are: the *thyro-arytenoids*, which are the openers of the glottis (9, 2,2); the *oblique arytenoids* (10, 3,3); the *thyro-cricoids* (11, 4,4); and the *posterior thyro-cricoids* (11 and 12, 5,5).

The Syrinx (Gr. *σύριγξ*, *surigx*, a pipe) or Lower Larynx is the voice-organ of birds; in most respects a more complicated structure than the larynx proper, and one so differently constructed in different birds that it affords characters of great significance in classification. The highest group of *Passeres*, for example, is signalized by the elaboration of this musical organ, the marvellously adroit fingering of the keys of which by the little muscular performers sends through the tracheal sounding-pipe the tuneful messages of bird's highest estate. A few degraded or disgraced birds, as the ostrich and the American vultures, have no bucolic organ at all, the trachea forking as simply as possible. Others, as the common fowl, have a fair syrinx, but no muscles whatever to modulate their pastoral lays. Others have one, two, or three pairs of intrinsic muscles; to which may or may not be added a sterno-tracheal with syringeal attachment. It is not so much the bulk or mere fleshiness of the syrinx that indicates musical ability; but the distinctness of the several muscles, and the mode of their insertion, which result in endless combinations of rotating and rocking movements of the parts, whereby an infinite modulation of the musical tones becomes possible. In *Oscines*, there are normally five or six pairs of muscles, without counting the extrinsic sterno-tracheales; and the gist of the arrangement, in these melodious Passeres, is the attachment of the muscles to the *ends* of the upper bronchial half-rings, as far as the third one. As Professor Owen remarks with appreciative feeling, "the manifold ways in which the several parts of the complex vocal organ in *Cantores* may be affected, each of the principal bony half-rings, as one or the other end may be pulled, being made to perform a slight rotatory motion, are incalculable; but their effects are delightfully

appreciable by the rapt listener to the singularly varied kind and quality of notes trilled forth in the stillness of gloom by the nightingale."

I should be able to make the plan of the syrinx clear to the student with the assistance of Macgillivray's beautiful figures. These are drawn from the rook, — a corvine croaker, indeed, but one whose syrinx is in good order, though he has never learned to play. As the modifications affect principally the soft parts covering and moving the music-box, one description of the latter is applicable to most birds. The last lower ring, or piece composed of several fused rings, of the trachea, at its bifurcation into bronchi, is enlarged or otherwise modified (fig. 101, [13], *aba*), and crossed below from front to back by a bony bar, the *pessulus* ([13], at *b*; [15], *a*), or bolt-bar, which, dividing it into lateral halves (as at [14]), forms thus two lateral openings instead of one median tube, — the beginnings of each bronchial tube. A membranous plate, strengthened by cartilage, rises vertically into the tracheal tube, forming a *septum*, or median partition, between the orifices of each bronchus. The free curved upper margin of this septum, extending of course, from front to back of the orifice, is called the *semilunar membrane;* being the edge of a partition common to both bronchi, it forms, in fact, the *inner lip* of each bronchial orifice; that is to say, the inner *rima glottidis syringis*, or lip of the syringeal mouth-piece. This membrane vibrates with the column of air, and is, in fact, one of the "vocal chords." Now the bronchial rings which succeed are not annular, circumscribing the bronchial tube, but are half-rings ([15], *b*, *b*), or arcs of circles to be completed by membrane, which forms more or less (scarcely or not half) of the circumference of the tube; this membranous part, termed the *internal tympaniform membrane* ([15], *c* to *c*), being on the side of the bronchus which faces its fellow, while the hard bronchial half-rings complete the rest of the cylinder. The membrane is attached to the pessulus above. This accounts for the whole bronchial tube and its vocal septum from its fellow. Now the concavity of the upper two or three bronchial half-rings, on the outer wall of the tube, but in its interior, is the place where is developed a certain fold of the mucous membrane, projecting into the tube opposite the septum, and forming the outer lip of the syringeal glottis; for this membranous fold, like the semilunar membrane, is set quivering in vocalization. The upper tracheal rings which enter into this arrangement are enlarged and otherwise modified. Thus are formed two "vocal chords," upon the vibrations of which the harmonious or discordant notes of the bird depend. The cords are struck by the hand of air indeed, but endless musical variations result from the play of the muscles in increasing or diminishing and variously combining the tension of the several parts of the instrument. In giving four pairs of intrinsic syringeal muscles (anterior external, anterior internal, intermediate, and posterior, besides the extrinsic sterno-tracheales), as figured in [16], *a*, *b*, *c*, *d* and *e*, Macgillivray is said to have understated the full oscine number, which is five or six. In the raven, Owen describes *five*, without counting the sterno-trachealis: *broncho-trachealis anticus*, anterior external; *broncho-trachealis posticus*, posterior external; *broncho-trachealis brevis*, posterior internal; *bronchialis anticus*, anterior internal; and *bronchialis posticus*. The general arrangement, however, is fairly indicated by Macgillivray in [16], where on the side of the syrinx, the muscles are seen to diverge from the tracheal lateral line to go to *ends* of the bronchial semi-rings.

The student will understand that my description is particular only as regards the oscine syrinx; that in birds at large every possible modification, almost, of lower tracheal and upper bronchial rings occurs, and with various musculation, or with none. The non-oscine rule for the muscles is, one on each side, if any; and insertion into mid-parts, not ends, of the bronchial half-rings. The latter character chiefly distinguishes the non-oscine syrinx when it has several muscles. As to situations of the syrinx, three have been recognized: the ordinary *broncho-tracheal*, in formation of which both bronchi and trachea take part; the *tracheal*, only known to occur in some American Passeres, as in *Thamnophilus* and *Opetiorhynchus*, situated wholly in the trachea, the lower part of which is extensively membranous; and the *bronchial*, wholly in the bronchi, as in *Crotophaga* and *Steatornis*.

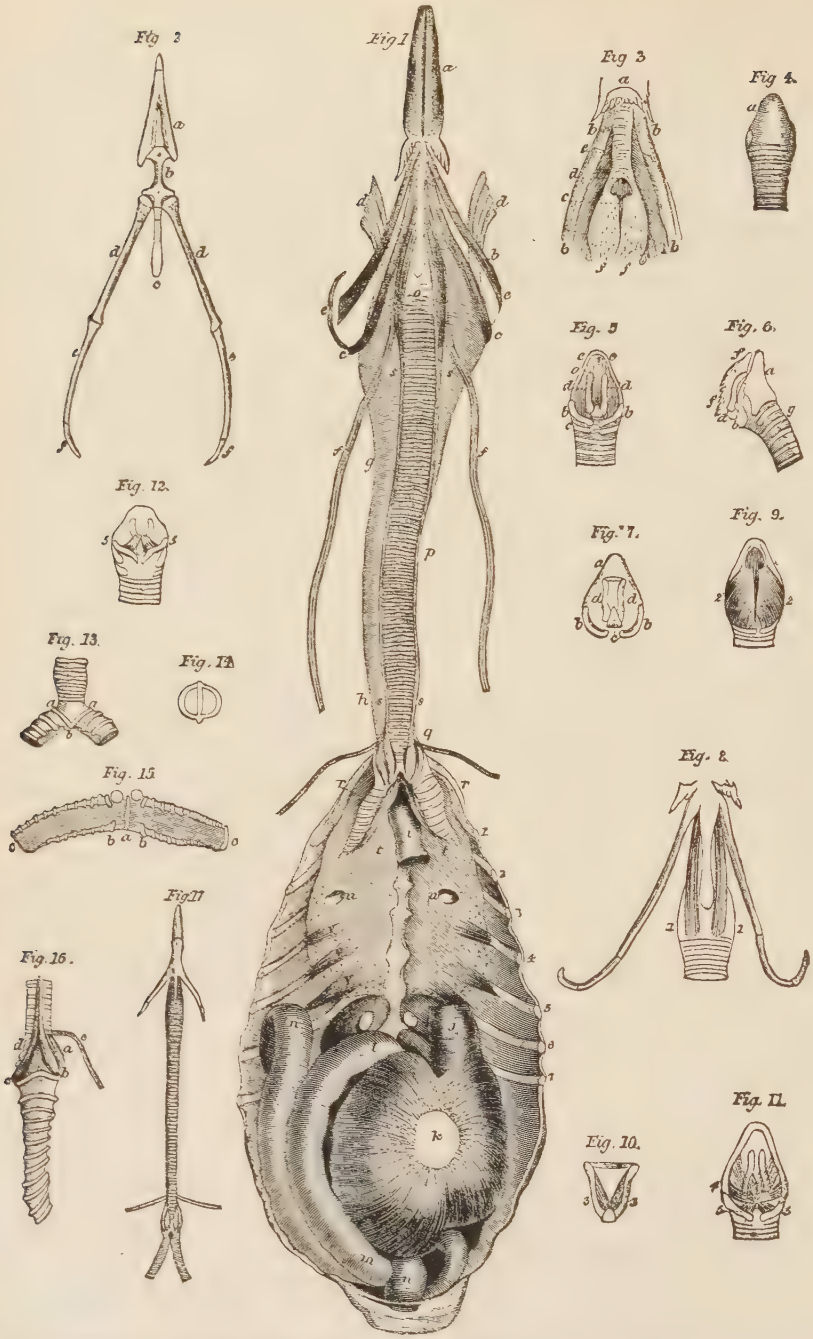


FIG. 101. — Respiratory and vocal organs of the Rook, *Corvus frugilegus*, an Oscine Passerine bird; nat. size, after Macgillivray. 1. *a*, tongue; *b*, basi-branchial, commonly called uro-hyal; *c*, *c*, horns of hyoid bone; *d*, *d*, genio-hyoid muscles; *e*, *e*, stylo-hyoid muscles; *f*, *f*, cleido-hyoid muscles; *g*, *h*, *i*, œsophagus; *j*, proventriculus; or secretory stomach; *k*, gizzard, or gigerium, the muscular stomach; *l*, *m*, *n*, *n*, intestine, duodenum to rectum;

o, *p*, trachea, or windpipe; *q*, inferior larynx, or syrinx; *r*, *r*, right and left bronchus; *ss*, *ss*, contractor muscles of trachea; *t*, *t*, lungs, with *u*, *u*, apertures communicating with thoracic air-cells; *v*, *v*, *v*, three pairs of muscular slips answering to a rudimentary diaphragm; 1, 2, 3, 4, 5, 6, 7, as many ribs. — 2. Hyoid bone; *a*, glosso-hyal, tipped with cartilage, its posterior horns being cerato-hyals proper; *b*, basi-hyal; *c*, basi-branchial proper, commonly called uro-hyal; *d*, *d*, cerato-branchials proper, commonly called apo-hyals; *e*, *e*, epibranchials proper, commonly called cerato-hyals, tipped with cartilage, *f*, *f*. — 3. Glottis, or opening of trachea in the mouth; *a*, base of tongue; *b*, *b*, horns of hyoid bone; *c*, rima glottidis, cleft or chink of the glottis; *d*, a triangular vacuity; *e*, an elastic ligament; *d* and *e* represent an epiglottis; *f*, *f*, a papillose surface. — 4. Larynx viewed from before (below); *a*, thyroid bone or cartilage. — 5. Larynx viewed from behind (above); *a*, thyroid bone; *b*, *b*, its appendages; *c*, cricoid; *d*, *d*, arytenoids; *e*, *e*, anterior border of thyroid, to which *d*, *d* are connected by two arytenoid ligaments. — 6. Larynx viewed from right side; *a*, thyroid; *b*, appendage; *c*, cricoid; *d*, arytenoid; *f*, *f*, cartilage attached to arytenoid; *g*, a tracheal ring. — 7. Larynx viewed from behind; *a*, thyroid; *b*, *b*, its appendages; *c*, cricoid; *d*, *d*, arytenoids. — 8, 9, 10, 11, 12. Muscles of the larynx; 1, 1 (fig. 8), thyro-hyoids; 2, 2 (fig. 9), thyro-arytenoids, or openers of the glottis; 3, 3 (fig. 10), oblique arytenoids; 4, 4 (fig. 11), thyro-cricoids; 5, 5 (figs. 11 and 12), posterior thyro-cricoids. — 13. Bifurcation of trachea; *aba*, last entire tracheal ring. — 14. Last entire tracheal ring, viewed from below, crossed by the pessulus. — 15. Bifurcation of trachea, and bronchi, viewed from below; *a*, pessulus, the bolt-bar, or "bone of divarication"; *b*, *b*, next succeeding tracheal half-rings. — 16. *a*, *b*, *c*, *d*, inferior laryngeal or syringeal muscles, not well made out in this figure; see text. But the typical oscine arrangement (acromyodian) is perceived, inasmuch as anterior (*a*) and posterior (*d*) intrinsic muscular masses go to *ends* of the first tracheal half-ring, at *b* and *c*; the extrinsic slip *e* passing to sternum; compare fig. 1, at *q*. — 17. Trachea, etc., of the nightingale, nat. size. (Compare figs. 3, 67, 72, 73, 74.)

The Song of Birds unlocks the great secret of Genesis to those who can hear the key-note. It is the closest approach, in animate nature, to the ringing of the hydrogen bells in the physics of light. The musical instrument figured (101, [17]) is the identical pipe the "great god Pan" first fashioned for a legacy to all time, as so sweetly said by Mrs. Browning: —

. . . . . .

"He tore out a reed, the great god Pan,
From the deep cool bed of the river.
The limpid water turbidly ran,
And the broken lilies a-dying lay,
And the dragon-fly had fled away,
Ere he brought it out of the river.

. . . . . .

"'This is the way,' laughed the great god Pan,
(Laughed while he sate by the river!)
The only way since gods began
To make sweet music, they could succeed.'
Then dropping his mouth to a hole in the reed,
He blew in power by the river

"Sweet, sweet, sweet, O Pan,
Piercing sweet by the river!
Blinding sweet, O great good Pan!
The sun on the hill forgot to die,
And the lilies revived, and the dragon-fly
Came back to dream on the river."

But the sad sequel, felt by Keats, when poor Psyche has seen and known, and Eros has found his wings: —

"So did he feel who pulled the boughs aside,
That we might look into a forest wide,
To catch a glimpse of Fauns, and Dryades
Coming with softest rustle through the trees;
And garlands woven of flowers wild and sweet,
Upheld on ivory wrists, or sporting feet:
Telling us how fair trembling *Syrinx* fled
Arcadian Pan, with such a fearful dread.
Poor Nymph, — poor Pan, — how he did weep to find
Naught but a lovely sighing of the wind
Along the reedy stream! a half heard strain
Full of sweet desolation, balmy pain."

The blessed blue-bird, "bearing the sky upon her back," is burthened with the same "light load of song" —

Have you listened to the carol of the bluebird in the spring?
Has her gush of molten melody been not poured forth in vain?
Ah! then the pulse has quickened, and a sigh, perhaps, has risen,
From the breast the bluebird's music stirs to thoughts that lack expression —
So tender, so tumultuous are the fancies thus aroused.
The bluebird's song breathes gladness — breathes the sweet and solemn triumph
Love feels when all love's passion melts in its own fruition.
Exquisitely subtile are the chords the bluebird touches —
Chords that quiver now in ecstasy, now thrill in fond expectancy,
Now die in dreams of all that might have been.
Hers is language to interpret, and translate in accents rhythmic,
All the yearning of young love to claim his own —
Of young love that trembles on the threshold of the passions,
And shrinks before the images his ardor calls to life.
Thus to the maiden musing come thronging thoughts unbidden,
When she hears this speaking echo of the hopes that glow within;
And the tell-tale blushes redden to the rose-tint on the bosom
Of the bird that dares to breathe her secret joy.
Thus to the youth impetuous, whose life is set to music —
Let love but laugh and beckon from afar —
Fulfilment sends a greeting in the soft voluptuous languor
That steals upon the senses if the bluebird's song be heard —
This song of wondrous gladness, ever bubbling, welling, gushing,
From a fountain full of promise, inexhaustible, divine!
Sweeter far these liquid accents when the buds of hope are blighted,
And the tree of knowledge bears its bitter fruit;
When memory sits brooding on the ashes of her birthright,
And sackcloth shrouds a heart that once was young;
For a silver chord is quickened where was greedy, silent sorrow —
Responding to a sympathetic touch:
The bird sings true and tender, with a precious burden laden,
With the tidings of a love that never dies.
So in the timid spring-time, when the world wears wreaths of roses,
Ring clear the joyous melodies of hope!
So in the summer season, when the wine of pleasure reddens,
Ring passionate the triumphs of the heart!
So in the sad, still autumn, when life bends beneath its burden,
When what might have been has never come to pass,
Rings once again this music on the crushed and wounded spirit,
Bringing light where all was dark and drear before:
All is not lost if the music that the bluebird bears be heeded,
For her mission is to tell us love is God.

Though it is a fact that "the *Chenomorphæ* are not provided with intrinsic syringeal muscles," there may be much truth in treatises *de cantu Cycni morituri* which have appeared from time to time, and to the number of which I may be pardoned for adding: —

How sadly sweet, how soft and low
Is the music born of pain —
How mournful sounds the ebb and flow,
What measured beats, what throb and throe,
In the wild swan's dying strain!

The archer, Death, and the twanging bow,
And the fateful shaft on-sped,
All state and grace and pride laid low,
Disordered plumes and crimson flow —
For the white swan's heart has bled.

But hear the mournful cry that rings
On the startled air of night!
As a spirit form in the darkness wings
Its way unseen, the wild swan sings
His psalm of life and light.

How sadly sweet the solemn strain —
The dirge of the dying swan!
That wondrous music, child of pain,
That requiem, sounding once again —
And a bird's soul passes on.

f. Splanchnology: the Digestive System.

The Alimentary Canal, or digestive tract, is a tube which passes through the body from mouth to anus, conveying food, the nutritious qualities of which are drawn off by the lacteals *in transitu* and assimilated, the refuse being voided. This is *digestion*. The canal is really a tube within a tube, being contained in the cavity below the bodies of the vertebræ, formed by the series of *hæmal arches* (p. 135). Birds are fast livers, their digestive operations, like the processes of respiration and circulation, being very active and effectual; they require proportionally great quantities of food. The voracity of the cormorant is proverbial, but it is probably not greater than that of the ethereal nightingale. Birds as a class are omnivorous; many species are as nearly omnivorous as any animals can well be; but the majority are either vegetarian or flesh-feeding. Very many birds feed upon fruits, hard or soft; but even these, when in the nest, are nourished for the most part upon the bodies of insects; and it may be truly said, that the great majority of birds are insectivorous. Birds seem to be the great controlling agency in the economy of nature, of the increase of insect life; agriculture would be difficult if not impracticable without them, and their economic value is simply incalculable. Insectivorous birds cannot be much interfered with, without destroying one of the most important and consequential of nature's many beautiful adjustments. The bird cries perpetual "échec!" to the insect. Even those birds which are mainly flesh-eaters, as the hawks and owls, are similarly beneficial, for the creatures they chiefly prey upon are the small rodents so fateful to husbandry. The carrion-eaters contribute largely to make tropical regions habitable to man. Various tribes of birds feed almost exclusively upon fish; and these sometimes reach the dignity of diplomatic and other political interests of mankind: nations have gone to war over the dung of such birds, guano-beds being to some of the South American powers a large item of their revenue. Chili and Peru have been fighting lately, and the United States have been wrangling, over the excrements of the alimentary canal of sea-birds. This tube, in general, is shortest, simplest, and most direct in the flesh- and fish-eaters, the nature of whose food assimilates already more nearly to the substance of their bodies than does that of the vegetarians. The tube is modified in different portions of its extent, for the prehension, retention, saturation, maceration, and comminution of food, and the mixture with it of other solvent fluids than those secreted by the mucous membrane of the alimentary canal itself. Hence arise the various modifications of its length, dilatation here, contraction there; the presence in its lining membrane of numerous follicles; and the annexation of various glandular organs. Being always longer than the body, the tube is necessarily coiled away in certain places; this folding taking place chiefly in the intestinal part of the tract. Modifications of structure make recognizable parts, as the mouth, gullet, crop, stomach, gizzard, intestine, cloaca, anus. Annex organs are the salivary glands, the liver, and the pancreas, all of which pour their secretions into the canal. This tube also receives the terminations of other systems of organs: the auditory organ of special sense; the respiratory system, which is at first a mere bud or off-set from the digestive; the urinary and the generative, which, though originally distinct, primitively and permanently open into the lower bowel. The intestine is also continuous with the cavity of the umbilical vesicle of the embryo, a primitive structure which disappears as the chick matures; and with that of the allantois, another embryotic organ which begins by budding from the intestinal cavity. Its connection with the system of blood-vessels is direct through the lacteals and thoracic ducts (p. 199). Its operations are automatic and spontaneous, of the "reflex" order;

that is, excited by the presence of food, — having work to do making it work, so to speak. Its innervation is chiefly by the pneumogastric and sympathetic nerves; and digestion is the most purely vegetative function, dealing with the raw materials of nutrition and consequently of the growth and repair of the whole body. The active factors in this transaction are several species or varieties of small creatures, called *Enteramœbæ;* they are all derived by descent with modification from the hypoblastic cells of the early embryo. Those of the canal itself form all the mucous epithelium of that structure, with its various secretory crypts, follicles, and villi; similar creatures, perhaps of different genera, form the lining of the salivary, hepatic, and pancreatic glands. Blood-vessels, in intimate connection with the digestive organs, form that special venous arrangement by which the blood coming from that part of the intestinal tract where chyle is made is collected in a *portal* system and sent through the liver, — in the embryo a sort of "great dismal swamp" which interrupts the ordinary current. The tube within the tube is fixed not only at its ends, but by various membranous connections, among them the *mesenteries*. We will notice the several departments of the alimentary canal, and its annexes; reference should be made to the colored frontispiece, and to fig. 101, where most parts of the digestive system are shown.

The Mouth and Tongue. — The most anterior of the special cavities in which the tube is divided, and the "manual" organ it contains. The mouth in general corresponds to the shape of the jaws, already sufficiently noted (pp. 100, 162). The anterior part is much hardened, like the beak; in fact, this hardness of the buccal cavity, and the absence, or very slight distinction, of a "soft palate," are among the peculiarities of a bird's mouth. There is consequently little distinction, if any, between mouth proper and *fauces*, or *pharynx*, which is the posterior part, leading directly into the gullet. Besides this communication the mouth receives the terminations of four special cavities. 1. The *posterior nares*, on the roof of the mouth posteriorly, generally a median slit, leading into the nasal chambers. 2. The generally single and median and more posterior opening of the *eustachian tubes*, which lead into the tympanum, and are the remains of the first post-oral visceral cleft of the early embryo. 3. The *glottis* (fig. 101, 3, *c*), a slit at the base of the tongue, the opening of the windpipe, and so of the whole respiratory system, which is defended by a rudimentary trap-door, the *epiglottis*, if any. 4. One or several pairs of orifices, the openings of the ducts of the *salivary glands*. These structures, corresponding to the parotid, submaxillary, and sublingual glands of mammals, vary extremely in their development. In woodpeckers, for example, and some *Raptores*, elaborate special salivary glands occur, having a glomerate structure, and a special "stenonine" duct. In many other birds, similarly compound but less elaborate submaxillary glands pour their secretion into the mouth by a series of pores. In most birds, however, the salivary glands are small, simple, and less distinct from various other sets of mucous crypts which open into the mouth. In the great bustard (*Otis tarda;* fig. 102) there is a singular buccal structure; a great pouch opening beneath the tongue, susceptible of distension during those amatory antics termed the "showing-off" of the creature. It is in fact an air-sac, but not of the kind already considered (p. 200), having no connection with the respiratory system. The narial, eustachian and glottidean apertures are commonly defended by retrorse papillæ; and other such

FIG. 102. — Gular pouch of bustard; copied by Shufeldt from Garrod. *a*, tongue; *b*, the pouch, opening under *a*, hanging in front of *c*, the trachea, behind which is the œsophagus, *d*, with its crop, *e*.

processes of mucous membrane, knobbed or acute, may occur elsewhere in lines and patches. The roof of the mouth is nearly all "hard palate," as already said; its soft floor is the mucous membrane and skin between the jaws, with muscular or other intervening structures. The principal flooring muscle is the *mylo-hyoid;* the *genio-hyoid* (fig. 101, [1], *d*) is another, which passes, like the first, from the mandibular to the hyoid bone; a third is the *stylo-hyoid* (*e*). The floor in some cases forms a pouch, which, as in the case of the pelican, is of great extent and susceptible of enormous dilatation (fig. 501).

The handler of the mouth, or lingual organ, is the tongue, which answers the same purpose as in other creatures: it is tactile, to some extent gustatory, sometimes prehensile, nearly always manipulatory. In some birds, as the pelican and ibis, and also the kingfisher, it is very slightly developed, — scarcely more than a pad at the bottom of the mouth, enjoying the most limited motion or other function. In some birds, as the parrot and duck tribes, and also the flamingo, the tongue is large, thick, and fleshy, quite filling the mouth. In the first-named of these, it is dexterously manipulatory; the morsel of food is managed between the tongue and upper beak; the tactile certainly and perhaps the gustatory sense is highly developed; and the fleshiness of the tongue may affect that power of articulate speech for which some parrots are justly noted. In the Lamellirostres just mentioned the tongue has lateral processes corresponding to the denticulations of the beak, and the under surface is horny at the end, like a human finger-nail. In the woodpeckers (figs. 73, 74) the tongue itself (glosso-hyal part of the hyoid) is reduced to a slight horny and spiny tip of the lingual apparatus; but other parts of that mechanism are so extraordinarily developed that the "tongue" appears as a *lumbriciform* (worm-like), spear-headed organ usually capable of great protrusion from the mouth, and therefore acting as a prehensile instrument, being bedewed for that purpose with tenacious saliva from the great salivary glands; while it is actuated in protrusion and retraction by specially developed muscles. In the snipe and many of the long slender-billed waders, the tongue is similarly slender, but not protrusible. The long narrow tongue of the toucans (*Rhamphastidæ*) is beset with slender processes, so that it seems feathery. The tongue of the humming-bird is very singular, — delicately thready, yet double-barrelled, — two tubes placed side by side, serving as siphons to extract the nectar of flowers. These and other interesting extremes aside, the ordinary style of a bird's tongue is flat, narrow, more or less sagittate or lanceolate, and tipped or sheathed in horn, commonly with lateral backward processes like the barbs of an arrow head, — the whole *glossal* structure upborne pretty distinctly upon the end of the basihyal bone. (See fig. 101, where [1], *a*, is such an ordinary tongue, and [2], *a–f*, is its whole skeleton.) Such horny tongues are commonly bifid at the extreme tip or there variously lacerate, or laciniate, or thready, — and even the fleshy tongue of some parrots, as the lories, is brushy at the end. The bony foundation of the tongue is the composite hyoid bone, already often mentioned (see p. 167); the free lingual part proper is based upon the glosso-hyal and its terminal cartilage; the roots curve more or less extensively about the base or more of the skull. The tongue is moved by some intrinsic muscles, as well as by those extrinsic ones by which it is connected to the skull, jaw, and windpipe (fig. 101, [1] and [8]).

The Œsophagus. — After comminution, if any, by the beak, and insalivation in the mouth, food passes directly through the pharynx into the *œsophagus* or gullet, — a musculo-membranous tube connecting mouth with stomach (fig. 101, [1], *g, h, i*). This is composed (besides its mucous membrane) of circularly disposed *constrictor* fibres, and longitudinal *contractor* fibres, of *Myamœba*, of the pale, smooth species (*M. lævis*). It has generally a pretty straight course, but may be diverted to one side or the other; and, in particular, is subject to various dilatations and contractions, permanent or temporary, aside from the mere distension caused by the passage of food. When the floor of the mouth is wide and loose, the gullet partakes of the same character above; the extreme case is afforded by the pelicans, especially *P. fuscus*. But the

gullet of many small birds, as various genera of *Fringillidæ* and *Corvidæ*, is much more distensible than is commonly supposed, and may be found crammed with seeds which there find resting-place for some time. The fish-eating birds, as herons, cormorants, loons, and others, have also capacious gullets. The Australian bustard, *Eupodotis australis*, has an œsophagus capable of such extraordinary distension that it hangs down in front of the breast when inflated with air, as it is in the amatory display in which that species is wont to indulge. Aside from mere distensibility of transient character, the œsophagus of many birds becomes modified anatomically into a special pouch, — the crop or craw, *ingluvies*, where the food is detained to be macerated in a special secretion before passing on to the true stomach. Such definite crops occur in birds of prey, which gorge such masses of food in their irregular voracious banquets that it cannot all be received into the stomach at once; and likewise throughout the orders of Columbine and Gallinaceous birds, which habitually feed upon seeds and other fruits so hard that they are advantageously macerated as a preliminary to true digestion. The common fowl furnishes a good illustration of a large, definite, single and median crop; in pigeons it is a pair of lateral dilatations (see frontisp.). In these latter birds, when they are rearing their young, the secretion of the ingluvies, always copious, becomes still more so, and of a milky character in consequence of the activity of the altered mucous surface: it is regurgitated into the mouths of the young, along with the macerated grains. "This phenomenon is the nearest approach in the class of Birds to the characteristic mammary function of a higher class; and the analogy of the 'pigeon's milk' to the lacteal secretion of the Mammalia has not escaped popular notice." Various other birds also feed their young by regurgitation of elaborated food; and very many similarly reject indigestible portions of their ingesta. Such vomiting is best known to be the wont of birds of prey, which habitually throw up the hair, feathers and bones of their victims, made up into the boluses called "castings"; but the practice is far from being confined to these flesh-eaters. The extreme case of emesis offered by birds is witnessed in the horn-bills (*Bucerotidæ*) which have been known to throw up the coat of their stomach without discomfort, — what a blessing it would be to some old topers if they could do the same, and grow another with equal ease! In fact, in consequence of the capacity and directness of the gullet, vomiting is very easy to birds, and with some it is a means of self-defence, — very effectual for instance in the cases of our vultures (*Cathartidæ*). Fish-eating birds, as herons, gulls, petrels, habitually vomit when wounded or otherwise molested.

The Proventriculus. — The tube just considered ends below in a special tract, variously dilated or not, but always peculiar in the presence of certain gastric follicles which secrete the digestive fluid proper. The "stomach" of a bird, in fact, is compound, consisting of a glandular or digestive portion, and a muscular or grinding part. The former is the *proventriculus;* whatever its size or shape, or whatever its magnitude in comparison with the grist-mill, it is recognized by the presence in its mucous surface of these gastric follicles, secreting the peptic fluid which *chymifies* the food. The follicles are perhaps always large enough for this part of the tube to be recognized by the naked eye, — the mucous membrane having here a thickened, velvety, vascular appearance. The glands are of various sizes and shapes, — usually simply tubular, sometimes clubbed or conical, or variously racemose (like a bunch of grapes). They are disposed in a zone around the tube, or in patches upon part of its surface, — in the darter (*Plotus*), very singularly in a separate lateral compartment looking like a crop. Details of the grouping of these solvent glands are interminable. Whatever its anatomical variations, and however like the end of the œsophagus it may simply appear to be, this *ventriculus glandulosus* is the bird's proper stomach (fig. 101, [1], *j*).

The Gizzard. — Mixed with the salivary, ingluvial, proventricular and other secretions of the mucous surface, and already chymified, the food of birds next passes directly into the giz-

zard, *gigerium*, or muscular division of the stomach, sometimes called the *ventriculus bulbosus*. The two are sometimes separated by a tract, sometimes immediately consequent. In the muscular gizzard, the food-grist is ground fine. To this end, the walls of the cavity become developed into a more or less powerful muscular apparatus, and the mucous membrane changes to a tough, thick, horny, occasionally even bony, lining; this callous cuticular lining being often very loosely attached, and even deciduous in some cases. The muscular arrangement is chiefly in two great masses, called the *lateral muscles*, converging to a central tendon; between them intermediate fibres may form a more or less distinct muscular belly. In the most powerful gizzards, the muscular tissue is very dense and dark-colored; the tendons brilliantly glistening, and the contained "millstones" extremely callous. Such a gizzard is well displayed by the common fowl or the goose. The opposite extreme is afforded by the carnivorous and especially the piscivorous birds, whose soft food requires little trituration, — it is all a matter of degree. How readily this part of the canal responds to the regimen of the bird, is witnessed in our cock-of-the-plains (*Centrocercus urophasianus*), — a bird whose gizzard is so slightly muscular as to appear like a membranous bag, though its gallinaceous relatives have extremely strong grinders. Its food is chiefly the buds and leaves of the wild sage (*Artemisia*), and grasshoppers. Increased muscularity of the gizzard has even been artificially produced. Birds whose grist is heavy habitually swallow gravel, that these small stones may mechanically aid in the grinding process. The action is so energetic, that in "auscultating" a fowl when the mill is in full blast, the noise of the grinding can be distinctly heard. The pebbles, in fact, have a function which leaves "hens' teeth" not entirely mythical. The kind of motion impressed upon the opposing pads of cuticle is alternating, — a rubbing back and forth to a slight extent. Peculiar dispositions of the callous surfaces are found in some pigeons, with corresponding peculiarity of the cross-section of the gizzard. In some of the cuckoos a matting of impacted hairs of lepidopterous insects has been mistaken for a coat of the gizzard itself. In the darter, which has a pyloric division or compartment of the gizzard, this is nearly filled with a mass of matted hairs, a peculiar modification of the epithelial lining, serving to guard the pyloric orifice. Folds of the lining membrane form a pyloric valve in many birds. The *pylorus*, or the *pyloric* orifice, is that opening by which food leaves the gizzard for the intestines; the orifice of entrance from the œsophagus is the *cardiac*. The two are always near together, and sometimes adjoining. (In fig. 101, [1], *k* is on the central tendon of the moderately muscular gizzard; the cardiac orifice is between *j* and *k*, and pylorus between *l* and *k*.)

The Intestine continues the alimentary canal to the cloaca. Any difference in the length of the whole tract, relatively to that of the bird, is chiefly produced by the foldings of the intestine, especially in the upper portion of its course. The extremes of proportionate length are perhaps not ascertained; but known to be from less than 2 : 1, to more than 8 : 1. In birds there is little or no distinction between "small" and "large" intestine, as to the calibre of the tube, nor is the latter succulated as in mammals. The former is considered to extend from the pylorus to the *cæca* (structures to be presently noticed). Above the cæca the intestine commonly receives its foldings and windings; below them it usually proceeds more directly, or quite straight, to the cloaca, forming literally a "rectum"; but in the ostrich this ultra-cæcal tract is longer than the rest, and convoluted. The cis-cæcal portion is conventionally divided into *duodenum*, *jejunum*, and *ileum*; there is, however, no positive anatomical distinction of these parts in any animal with which I am acquainted. In birds, a "duodenum" is perhaps as distinct as ever; it forms the most constant duplication of the intestine, the pancreas being lodged in this *duodenal fold* (fig. 101, 1, *l*, *m*, *n*). The course of the intestine is otherwise very various in different birds. The upper end, near the pylorus, receives the hepatic ducts; and food is *chylified* after impregnation with the biliary and pancreatic fluids: a process furthered by the proper secretions of the intestinal follicles. The *chyle* is drawn off by the

lacteals already described (p. 199), and the unassimilable refuse of the food becomes excrementitious.

Cæca (Lat. *cæcus*, blind; in the nom. pl. *cæca*; sing. *cæcum*). — The "blind guts," so called because they end in *culs-de-sac*, are of two kinds. One is the *umbilical cæcum*, or *vitelline cæcum*, a rudimentary, or rather vestigial, structure, the remains of the open duct by which the cavity of the umbilical vesicle (an embryonic organ) communicated with that of the intestinal tract. It is ordinarily not to be noted at all; but it is said by Owen to have been found half an inch long in the gallinule, an inch in the bay ibis, and dilated into a sac an inch in diameter in the *Apteryx*. The structures ordinarily called *cæca*, or *cæca coli*, for they are usually paired, are pouches or diverticula which set off from the intestine proper at the junction of the ileum with colon; but there is nothing in the intestine itself to mark this point, so that when cæca are absent, as frequently happens, no distinction of ileum from colon or rectum is appreciable. No part of the intestinal tract is so variable as the cæcal; so that presence or absence of these appendages furnishes zoölogical characters now-a-days taken very commonly into account in framing genera and families. There are no cæca, as in the turkey-buzzard and some pigeons; there is a single small cæcum in herons. From a condition of extremely small size, like little buds upon the intestine, cæca are found to elongate to extraordinary dimensions; and the large specimens are frequently saccate or clubbed, with slender roots. In geese and swans the cæca are a foot long, more or less; in some grouse they are said to be a yard long. In the ostrich, the mucous membrane is thrown into a spiral fold. However developed, the physiology of these intestinal appendages is, the detention of food until all its nutritive qualities are absorbed, and increase of the absorbent surface.

The Cloa'ca (fig. 101, [1] *k*) or "sewer," very well named, is the termination of the bowel, — an oval or globular enlargement of the rectum, of sufficient capacity at least to contain the completely shelled egg. For, not as in placental mammals, the uro-genital and digestive organs are behind-hand in their evolution, and do not entirely lose connection with each other. Nor is there in birds any distinct bladder; but a cavity, originally that of the allantois of the embryo, persists in common with that of the intestines, and is the *cloaca*. Such incomplete distinction between the two as there may be, by a folding of mucous membrane or partial compartment of the whole, results in cloaca proper and *urogenital sinus*, in which latter are the papillose orifices of the *ureters*, one on each side, from the kidneys; and of the single oviduct (♀) or paired sperm-ducts (♂), from ovary or testes. The urine of birds not being liquid requires no more of a bladder than the sinus furnishes. The same cavity contains the penis of those birds, as the ostrich and drake, which are provided with an organ of copulation. A peculiar anal gland, the *bursa fabricii* (see frontisp.), also opens into the cloaca. Refuse of digestion, the renal excretion, the spermatic secretion, and the product of conception, are discharged by a single anal orifice, the two former *en masse*.

Being intimately related to dietetic regimen, and so to the habits of birds, the alimentary canal varies greatly, — even more than my slight sketch shows, — and consequently affords good zoölogical characters in the details of its construction. But of all the anatomical systems, this is the one most variable as a matter of *physiological adaptation* (see p. 67). Its characters, even when they seem weighty, are therefore peculiarly liable to be fallacious as indices of natural affinities, and must be applied with discreet caution to morphological classification. Such are commonly only of generic significance. Thus in pigeons the cæca and even the gall-bladder may be present or absent in neighboring genera.

Alimentary Annexes. — Some of these, as the salivary glands, have been noticed already. The two most important bodies connected with the digestive tract, and properly considered

adjuncts, are the pancreas and the liver. The former is that kind of lobulated salivary gland which in mammals is called the "sweetbread." It lies in the duodenal loop, along which its loosely aggregated lobes extend. Its ducts, formed by the successive union of smaller efferent tubes, are two or three in number; they pierce the intestine a little below its commencement at the pylorus, and pour into the canal the pancreatic juice, which has the property of emulsionizing fat. The *liver* is a well-known glandular organ of very special structure and function, secreting the fluid called *bile*, also received into the intestine. It is of moderate size in birds, and deeply divided into two principal (right and left) lobes: in some birds there is also a smaller lobe; and one of the large lobes may also be divided. The lobes dispart above to receive between them the apex of the heart; they are held in place by pleuro-peritoneal folds contributing to form the thoracic-abdominal air-cells. The viscus receives venous blood from the extensive portal system of birds; two hepatic veins then conduct it to the post-caval. The emunctory ducts, carrying off the bile, are two or three in number. One at least goes directly to the intestine, and another to the gall-bladder, when that cyst exists; in which case there is a separate cystic duct from the bladder to the intestine, no *ductus communis choledochus*, or duct common to the hepatic substance and its cyst, being formed in birds. Two hepatic ducts may coexist with a cystic duct, making three to the intestine, all separate; two is the rule when there is no gall-bladder. These emunctories commonly enter the intestine some distance apart, and after the pancreatic ducts. The gall-bladder is generally present, frequently absent; it may occur or not in closely related genera of birds.

g. OÖLOGY: THE URO-GENITAL ORGANS.

The Urinary and Generative Organs may be conveniently considered together, not only on account of their close anatomical relations, but because their physiological functions, totally diverse in adult life, are primitively related in the most intimate manner. For it is a singular fact that the mean office of straining urine out of the system is at first sustained by a structure (wolffian body), in closest connection with which, in the female, actually as a part of which, in the male, are later developed those organs (ovary and testis) whose exalted office is creative; for these permanent genital glands procreate the microscopic creatures called *Dynamamœbæ*, the marriage of which results in the reproduction of a complex organism like the male or female parent. (See figs. 103, 104, and following.)

The Wolffian Bodies, or *primordial kidneys*, are a pair of tubular structures which appear very early in the progress of development of the embryo, beneath the spinal column, in front of the fore end of the future kidneys; with each of them is developed a duct, the *wolffian duct*, which carries their excretion into the cavity of the allantois (the future cloaca). Upon the appearance of the true kidneys, the transitory wolffian bodies and ducts lose their urinary function; they ultimately disappear from the female, for the most part, leaving only a trace of their former existence in certain vestigial structures (*parovaria*, etc.); in the male, likewise, they atrophy, but not to the same extent; for a portion of the bodies persists as an accessory (epididymal) portion of the testicle, and their ducts persist as the sperm-ducts, or *vasa deferentia*. Meanwhile, in closest connection with the wolffian bodies, appears a pair of organs, the *genital glands*, for a while exactly alike. If the new creature is to become *female*, the *genital gland* develops to a certain complexity of tissue and becomes the *ovary*; while a certain duct, the *müllerian duct*, developed coincidently to connect such ovary with the cloaca, becomes the *oviduct*. In birds usually only one ovary and oviduct (the left) becomes functional. If the new creature is to become *male*, the same *genital gland* develops to a higher degree of complexity, acquires a tubular structure, and becomes the *testicle*; it connects with remains of the wolffian body, and the wolffian duct becomes the permanent sperm-duct, conveying the

product of the male function to the cloaca, just as the oviduct conveys the product of the female function to the same sewerage. Thus the testicle of the male and the ovary of the female are homologous, in fact primitively identical organs, upon which sexual difference is impressed by the greater complexity of structure acquired if the sex is to be male; a female being, anatomically and physiologically, simply an imperfect male, arrested at one stage of her physical progress to male perfection of structure; and the whole nature of the female bears out the same relation of inferiority. But the oviduct of the female, and the sperm-duct of the male, though physiologically identical, having the same function of conveying the products of generation from the genital gland to the light of day, are not anatomically the same; for in the case of the female, whose wolffian duct has disappeared, the müllerian is the oviduct; in the case of the male, in which no müllerian duct appears, the wolffian is the sperm-duct. The two are analogous, not homologous (a good illustration — see p. 68). But it must be further observed that while the sperm-duct conveys only the masculine essence from centre to periphery, the oviduct conveys the feminine material from centre to periphery, and *also* the male essence in the opposite direction; for, upon coitus, which is direct in all birds, the spermatozoa, deposited in the cloaca of the female, find their way up through her oviduct to the ovary, there to accomplish impregnation of the ovarian ova, the fecund product then passing down by the same avenue. All that relates to the mysteries of generation, — both the structure and function of the reproductive organs, and the maturation of the product of conception, is properly *Oölogy* (Gr. *ὠόν, oon*, an egg); though the term is vulgarly used to signify merely a description of the chalky substance in which the egg of a bird is finally invested. The anatomy of the egg is *Embryology*. An egg, or *ovum*, is simply the product of conception up to the time that product acquires an independent existence: while still connected with the female tissue of the ovary, and before or after it amalgamates with the male element, it is an *ovarian ovum;* more or less incompletely matured, it is an *embryo* or *fœtus*, — the former term being commonly applied to the unhatched young of birds. The only difference between the "egg" of a "viviparous" mammal and that of an "oviparous" bird, is in the albuminous and cretaceous envelopes of the latter, and its speedy expulsion from the body of the female to be hatched outside, without anatomical connection with the mother after the hard shell is formed; whereas, in most mammals, the ovum is retained in a dilated part of the müllerian duct (uterus or womb) until it "hatches"; but mammal and bird alike "lay eggs," the essential germinative part of which is identical. Appreciation of these facts, and a proper idea of the relations of the mature sexual organs to the wolffian bodies is necessary to any understanding of the parts and processes concerned in reproduction.[1] We have here to consider the permanent as distinguished from the transitory kidneys, and may then recur to the subject of generation.

Fig. 103. — Uro-genital organs of male embryo bird; from Owen, after Müller. *a*, kidneys; *b*, ureters; *c*, wolffian bodies; *d*, their ducts, to be sperm-ducts; *e*, genital glands, to become testicles; *f*, adrenals.

Fig. 104. — Uro-genital organs of female embryo bird; from Owen, after Müller. *a*, kidneys; *b*, wolffian bodies; *c*, genital gland, to become ovary; *d*, adrenals; *e*, ureters; *f*, wolffian ducts, to disappear; *g*, müllerian ducts, to become oviducts.

[1] The matter may be further illustrated by the two figures borrowed from Owen (after Müller). In both figs., the large dark masses, *a*, are the permanent kidneys, whose ducts, *b* in fig. 103, *e* in fig. 104, are the ureters, emptying into the cloaca. In fig. 103, male, *c* is the wolffian body, whose duct, *d*, persists as the sperm-duct, conveying

The Kidneys (Lat. *renes*, Engl. *reins*, adj. *renal;* figs. 103, 104, *a;* 105, *x*) differ much from those of mammals in physical characters, though identical in function, —that of straining off from the blood certain deleterious substances in the form of urea; whence they are sometimes called *emulgent* organs. Their office of purification is analogous to that of the lungs, which decarbonize the blood, and to some extent vicarious, as is that of excretory organs in general. As the lungs are closely bound down to the thoracic region of the trunk, so are the kidneys impacted in the pelvic region, being moulded to the sacral inequalities of surface (p. 141). They are paired, but sometimes connected across the median line by renal tissue; they have no special renal artery, but derive their blood from various sources; and blood from them takes part in the hepatic portal system, no reniportal being accomplished. They have little or nothing of the particular mammalian configuration which has made "kidney-shaped" a common descriptive term; being elongated, somewhat parallel-sided and rectangular, flattened bodies, lobated into a few large compartments, and lobulated into many lesser divisions; their figure depends much upon that of the pelvis. They are very dark-colored, rather soft, easily lacerable, and appear to the naked eye to be of a granular substance, without distinction of "cortical" and "medullary" portions. Nor is there any "pelvis" of the kidneys in which the uriniferous tubules empty together by numerous ducts as into a common basin. Each *ureter* (figs. 103, *b;* 104, *e;* 105, *y*), or excretory duct, is formed by reiterated reunion of the *tubuli uriniferi*, after the manner of a pancreatic duct; each ureter passes down behind the rectum and opens into the lower back part of the cloaca, —much like a mammalian ureter into the base of the bladder. The original cavity of the allantois remains to furnish no more of a *urinary bladder* than some special dilatation of the cloaca represents; but this rudimentary bladder, as distinguished from the uro-genital sinus in which the ureters terminate alongside the sperm-ducts, is well marked in some birds; being in the ostrich, for example, a considerable enlargement of the cloaca between the termination of the rectum proper and the uro-genital compartment of the sewer. The renal excretion is not watery as in mammals, but semi-solid, and voided with the fæces, of which it forms part.

The kidneys are capped by a pair of small yellowish bodies, the *supra-renal capsules* or **adrenals** (figs. 103, *f;* 104, 105, *d*), the nature of which is undetermined. They are chiefly interesting to the practical ornithologist in their liability to be mistaken for testes in examining specimens for sex (see p. 45).

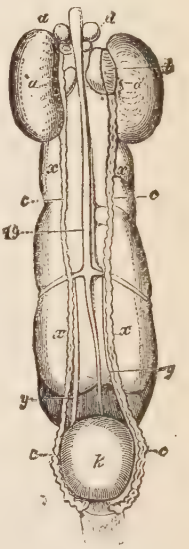


FIG. 105.—Uro-genital organs of the domestic cock; after Owen. *a*, testis; *b*, epididymis; *c*, sperm-duct or vas deferens; *d*, adrenal; *k*, cloaca; *x*, kidney; *y*, ureter.

Male Organs of Generation.— The *testis* (Lat. *testis*, pl. *testes*, a witness; fig. 105, *a*) or *testicle* has been already sufficiently noticed as to its general appearance and position (p. 46). As said above, it is the essential male organ, consisting of the primitive indifferent genital gland (fig. 103, *e*) in its highest state of development as a tubular secretory organ, connected with the remains of the wolffian body as a part of its efferent structure (*epididymis;* fig. 105, *b*) and with the original wolffian duct as its *vas deferens* (figs. 103, *d;* 105, *c*), or efferent duct, by which the semen is conveyed to the cloaca. The original glands normally remain paired, and both are usually functionally developed to corresponding size, shape, and activity; they remain in their embryonic situation in front of the upper part of the kidneys; and such difference

semen from *e*, the testis. In fig. 104, *b* is the wolffian body, whose duct, *f*, disappears; and *g* is the müllerian duct, becoming the oviduct, to convey the egg from *c*, the ovary. Thus *e*, fig. 103, and *c*, fig. 104, are the homologous genital glands, becoming either testis or ovary: but the sperm-duct, *d*, fig. 103, is not the oviduct, *g*, fig. 104.

of appearance as they present under different circumstances is mainly seasonal. For birds, as a rule, procreate only at particular times of the year, rarely having more than one or two broods of young: the functional activity and quiescence of the testes correspond, as the enormous swelling of the gland during the breeding season is one of the peculiarities of the bird's organ. This may be related to the absence, in birds, of specially formed *vesiculæ seminales*, or seminal reservoirs; though certain contortions and dilatations of the sperm-ducts which are to be observed may imperfectly answer to detain the secretion until circumstances render it available. The passage of the sperm-duct is along the face of the kidneys, generally in company with the ureters; the opening is by a papilla upon the surface of the uro-genital sinus. These papillose terminations of the sperm-ducts are erectile to a degree, and answer the purpose of paired penes in those birds which are not provided with better-formed copulatory parts. *In coitu*, the cloacal chambers containing the orifices of the genital ducts are opened, and the more or less protruded papillæ come in contact or close juxtaposition. In cases in which a penis or two penes are developed, the urethral passage is a groove, never a tube, though cavernous and even muscular tissue may be developed; and in any case of such an intromittent apparatus, it has cloacal invagination when not operative (see p. 680). These organs, in all their variety, are of the sauropsidan, not mammalian, type; though in some respects the structure approaches that seen in the non-placental mammals. No prostate or cowperian glands exist in birds.

The sole office of the testis, or *oöphoron masculinum*, is the secretion of *semen*, associate structures being simply accessory, for the conveyance of that vital substance and its transference to the opposite sex. The seminal *fluid* itself is merely the vehicle of transport of the *spermatozoa*, in which their activity may be freely exercised in their intuitive struggles to gain access to their mates in the ovary. It is literally a "sea of life" in which the minute creatures swim in shoals to their destiny, — and their fate in any case is death. If they successfully buffet the waves of fate they find a watery grave in the ovum at last; if that haven be not reached they simply perish in mid-ocean. The spermatozoa, or seminal animalcules, or male *Dynamamœbæ* (figs. 106, 107), are the exact counterparts of ovarian ova, in so far as they are single-celled animals of a very low grade of organization; but their activity and intelligence is marvellous, and still more so is the mysterious attribute with which they are endowed of assimilating their protoplasmic substance with that of the ovum; with the result that the thus fecundated ovum is capable of procreating itself by fission for a period until a mass of similar creatures is engendered; from which mass is then speedily evolved the complex body of the Bird. The corresponding female *Dynamamœbæ* (ovarian ova) are simple spherical animalcules, physically indistinguishable from an ordinary encysted *Amœba;* but the spermatozoa are remarkably distinguished in appearance, furnishing probably the best marked case of sexual characters to be found among the *Protozoa*, to which class of animals they belong. The spermatozoa resemble flagellate infusoria or ciliated endothelium cells, though they each have but a single whip. They are of extremely minute size, much smaller than their females, and filamentous; more or less thickened and sometimes wavy at their nucleated heads, whence protrudes an excessively delicate thready tail, endowed with great vibratory energy. They may be likened to diminutive attenuated tadpoles, which swim by lashing the tail in the seminal fluid. Under the microscope shoals of these curious creatures may be seen swimming in the sea, nosing about in search of the ovum, butting their heads in wrong places, backing out and trying again in another direction; with such success that out of myriads a score or so may gain their end. It

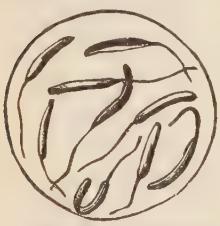


FIG. 106. — Spermatozoa of domestic cock, greatly magnified; from Owen, after Wagner and Leuckart.

FIG. 107. — Spermatozoa of sparrow, greatly magnified; from Owen, after Wagner and Leuckart.

will be seen that they have a long journey to accomplish; for, liberated in the cloaca of the female, they have to swim through the whole length of the oviduct to the ovary. Besides such physical difference between the male and female *Dynamamœbæ* as I have indicated, they differ in their place and mode of birth; and in this difference lies the very gist of sex. The original indifferent genital gland above described, arrested, as said, at a certain stage of development and therefore female — the ovary — produces its eggs from its surface-cells, which subside into the ovarian tissue, and are quietly packed away there as ovarian ova, ready to ripen and awaken to impregnation in due course. The same gland, further developed into a testis, gives active birth to the spermatozoa in the tubules of its complicated interior tissue. In the former case, the superficial cells slowly ovulate; in the latter, the cells lining the interior speedily spermate; in a word, the testis is as literally *viviparous* as is the ovary *oviparous*, — and these conditions are certainly no insignificant indices of relative development in the scale of being. The spermatozoa appear in some animals to be set free in myriads from the walls of the seminal tubules whence they directly issue; in birds, they are described as appearing coiled or otherwise packed in delicate sperm-cells, which speedily rupture and discharge the creatures in the current of the seminal fluid, where they take up the course and display the energetic actions above noted. Either case has its parallel among ordinary Protozoans; the former corresponding to the process of budding or gemmation, the latter to that of interior fission and discharge of numerous progeny by rupture of the envelope. The final conjugation of spermatic filaments with ovarian ova is simple fusion, such as any ordinary sexless amœboid animal may practise to blend its protoplasmic substance with that of another. But there is this difference, that in the case of *Dynamamœba* it is a true sexual congress, usually *polyandrous*, and still more of a one-sided affair in that the female *Dynamamœba* is at the time in a more or less quiescent, *encysted* state.

Female Organs of Generation. — The connection between the male and female organs of generation is naturally so close that in what has preceded it has been scarcely possible to speak of the former without reference to the female counterparts. I have thus far endeavored to state clearly the nature of the originally sexless genital gland; the difference in the same gland when afterward sexed male or female; and the character of the spermatic offspring of the male gland. In reading that lesson the novitiate in such Eleusinian mysteries must not mistake the language I have used to describe the male *Dynamamœba*, or spermatozoön, as applicable to anything in the development of the female *Dynamamœba*, or ovum, into the chick; for all said thus far only relates to the bringing of the spermatozoön into contact with the ovum, preliminary to the initial step of the ovum in its course of development. It is this female *Dynamamœba* — this primitive ovarian ovum, the germ of the chick, which corresponds to and is the counterpart of the male *Dynamamœba*, on meeting and mingling with which fecundation is accomplished; the impregnated ovum being then empowered to take up its marvellous march. Conjugation of the opposite *Dynamamœbæ* occurs either in the ovary or upper part of the oviduct, — most probably the former. One or several spermatozoa — usually more than one — accomplishing their journey up the oviduct, and finding their affinity, insinuate themselves into the substance of the ovum, and die there, dissolved in amorous pain; that is to say, they melt into the substance of the ovum. The now fertile result, consisting of the mingled protoplasm of the opposite amœbas, is to all appearance precisely the same as the original infecund ovum — yet there is all the difference in the world, as the result shows.

The general character of the ovary of a bird has been already indicated (p. 46). The principal superficial difference in appearance when the ovary is in functional activity, from the corresponding organ of a mammal, is that the ova develop to such a size, in ripening in the ovary before leaving it for the oviduct, that the organ looks like a bunch of grapes, — very large and conspicuous. The oviduct is the musculo-membranous tube (modified müllerian

duct) which conveys the ripened ovum, and in its passage provides it with a quantity of white albumen, and finally a chalk shell. A bird's oviduct is the strict morphological homologue (p. 68) of a mammal's fallopian tube, uterus and vagina, — more accurately, of one fallopian tube, one half of a uterus, and one half of a vagina; for the uterus and vagina of a mammal result from the union of both müllerian ducts; whereas in a bird only one — the left usually — is normally developed. Functionally, the oviduct is also analogous (p. 68) to the mammalian uterus, inasmuch as it transmits the product of conception, and detains it for a while, in the initial stage of its germination, as we shall see in the sequel; though all but the very first steps in the development of the chick are taken during incubation, the egg having so hastily left its uterine matrix. These structures — ovary and oviduct, fig. 108, — are most conveniently described as we trace the course of the ovum from its origination to its maturity. This record differs considerably from the corresponding course of events in a mammal, inasmuch as the ovum of a bird, though primitively identical with that of any other animal, acquires special albuminous and cretaceous envelopes which the mammalian ovum, developed in the body of the parent, does not require. The process is termed *ovulation.* Ovulation, which is the formation of an egg in the bird, must not be confounded with *germination,* which is the formation of a bird in the egg. The former can be accomplished by the virgin bird, which may lay eggs scarcely differing in appearance from those which have been fecundated, but germination in which is of course impossible. The course of ovulation, and afterward of germination, is now to be traced.

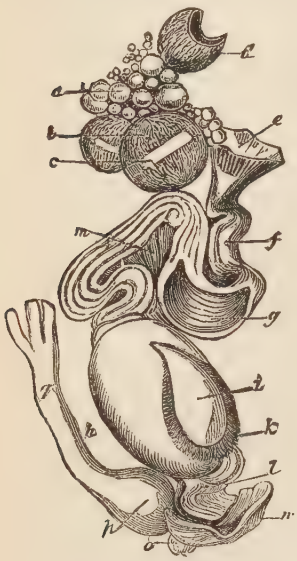


FIG. 108. — Female organs of domestic fowl, in activity; from Owen, after Carus. *a*, *b*, *c*, *d*, mass of ovarian ova, in all stages of development; *b*, a ripe one; *c*, its stigma, where the ovisac or calyx ruptures; *d*, a ruptured empty calyx, to be absorbed; *e*, infundibulum, or funnel-shaped orifice of the oviduct; *f*, next portion of oviduct; *g*, follicular part of oviduct; *m*, mesometry, membrane steadying the oviduct; the reference-line, *m*, crosses the constricted part or isthmus of the oviduct; these parts secrete the white of the egg; *k*, shell-forming or uterine part of oviduct, in which is a completed egg, *i*; *l*, lowest or vaginal part of oviduct, opening into uro-genital sinus of the cloaca, *n*; *o*, anus.

Ovulation. — The *ovum* begins as a microscopic point in the ovary, the *stroma* or tissue of which is packed with these incipient eggs. It is primitively just like any other female *Dynamamœba*, from that of a sponge up to that of a woman, — a naked simple cell, capable of exhibiting active amœboid movements. It consists of a finely granular protoplasm, the *vitellus*, or *yelk*, enclosed in a delicate structureless cell-wall, the *vitelline membrane*, called the *zona pellucida* from its appearance under the microscope. Imbedded in the vitellus is a nucleus, or kernel, the *germinal vesicle;* in this is a nucleolus, or inner kernel, the *germinal spot.* The ovum occupies a tiny space in the ovary, the cellular walls of which constitute an *ovisac*, or *graafian follicle.* Now if such an ovum as this were mammalian, it would, without material change, burst the ovisac, be received into the fallopian tube and conveyed to the uterus; where, supposing it already fertilized, the whole of its contents would develop into the body of the embryo. It would therefore be *holoblastic* (Gr. ὅλος, *holos*, the whole; βλαστικός, *blastikos*, germinative). It is different with a bird or other "oviparous" animal, the egg of which has to hatch outside the body; for provision must be made for the nourishment of the developing chick, thus separated from the tissues of its mother. Such provision is made by the accumulation about the ovum of a great quantity of granular protoplasmic substance, which forms nearly all the large yellow ball called in ordinary language "the yelk" of an egg. None of this adventitious substance goes to form the embryo; it is what the embryo feeds on during

its formation. A bird's egg is therefore *meroblastic* (Gr. μέρος, *meros*, a part, and βλαστικός), and we must carefully discriminate between the great mass of yellow *food-yelk*, as it may be called, and a small quantity of "white yelk," the true *germ-yelk*, which alone is transformed into the body of the chick. The latter forms the *cicatricle*, vulgarly called the "tread"; that small disc, visible in most birds' eggs to the naked eye, which appears upon the surface of the great yellow ball, floating in a pale thin yelk which penetrates the denser and yellower food-yelk by a cord of its own substance leading to a central cavity, the false yelk-cavity, around which the food-yelk is deposited in a series of concentric layers like a set of onion-skins. The whole mass is surrounded by a delicate structureless yelk-skin, called the *vitelline membrane* (whether this be the original vitelline membrane of the *Dynamamœba* or not; i. e., whether the food-yelk has accumulated inside or outside the original *zona pellucida*). All this enormous accumulation, effecting what is called a *metovum* or after-egg, to distinguish it from the *protovum*, or primitive state of the egg, goes on in the ovary, and in the ovisac of each ovum; with the ripening of the ovum, the ovisacs become distended to a corresponding size, and the whole ovary acquires the familiar bunch-of-grapes appearance. With such maturation of the fruit, the connection with the rest of the ovary lengthens into a stalk, or *pedicel*, by which the ripe ovum hangs to its stock, like any fruit upon its stem, ready to burst its skin and fall into the open mouth of the oviduct. Such rupture of the graafian follicle (ovisac), in its now distended state known as the *capsule* or *calyx*, occurs along a line where the numerous blood-vessels which ramify upon its surface appear to be wanting, called the *stigma:* this is rent; the ovum slips out of its calyx, like the substance of a grape pinched out of its skin, and falls into the oviduct. After this discharge, the empty calyx collapses, shrivels, and ultimately disappears by absorption. (See expl. of fig. 108).

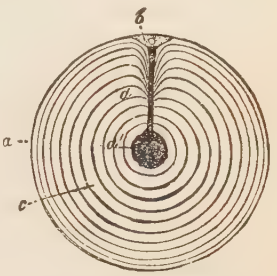


FIG. 109. — Meroblastic ovum (yelk) of domestic fowl, nat. size, in section; after Haeckel. *a*, the thin yelk-skin, enclosing the yellow food-yelk, which is deposited in concentric layers, *c*, *d*; *b*, the cicatricle or tread with its nucleus, whence passes a cord of white yelk (here represented in black) to the central cavity, *d'*.

The ovum thus acquires the full size of its yelk in the ovary, — becoming, as in the case of the hen, a yellow sphere an inch in diameter.[1] Notwithstanding its enormous distension with food-yelk, it is still morphologically a simple cell, affording the maximum dimension of any known protozoan or single-celled animal. Entering the oviduct, the germ-yelk part of the whole mass is fertilized by spermatozoa, unless this process has before occurred in the ovary, and in its passage through that tube the yelk-ball becomes invested successively with the mass of transparent albumen known as the "white" of the egg, and finally by the chalk shell — both secreted by the mucous membrane lining the oviduct.

During its functional activity, the left oviduct (there being usually only this one) becomes highly developed, both as to its muscular walls, which by their contractility embrace the ovum closely and squeeze it along, and as to its mucous secretory surface. It is supported by peritoneal folds forming a *mesometry*, like the mesentery of the intestines; its whole structure and office are quite like those of a length of intestine. The upper end of the singularly serpentine oviduct is dilated into an *infundibulum*, or funnel-like mouth, corresponding to the fimbriated extremity of the mammalian fallopian tube, and constituting a *morsus diaboli*, or "devil's grip,"

[1] How great this is can only be appreciated by comparison. The human egg, on escaping from the graafian follicle, is said to be from $\frac{1}{250}$ to $\frac{1}{150}$ of an inch in diameter. Taking it at $\frac{1}{200}$, there would be 40,000 in a square inch, and in a cubic inch 8,000,000. The largest bird's egg known, that of the *Æpyornis*, is said to have a content of about a gross of hen's eggs — 144. Supposing the yelk of the *Æpyornis* egg to bear the usual proportion to the other contents of the shell, and allowing for the difference in bulk between a sphere and a cube of equal diameters, there would still be somewhere about a billion human eggs in one *Æpyornis* egg-yelk, — roundly, a mass of them equal to that of the germs of more than one-half of the present population of the globe.

which gets hold of the ovum to drag it down to the common lot of mortals from its high ovarian birth. The infundibulum receives from the mesentery a delicate tunic of unstriped muscular fibres, which are so disposed as to dilate that orifice for the reception of the ovum; and during the venereal orgasm the mouth of the tube is supposed to seize upon the ripest egg. The actual anatomy of the arrangement, and the whole operation, is strangely suggestive of one of the oldest myths respecting the serpent which bore the egg of the world in its jaws. The mucous lining of the oviduct consists of a layer of ciliated epithelium; the membrane has a different character in successive portions of its extent. Above, when the tube is not distended with its burthen, the lining is thrown into lengthwise folds, which lower down become spirally disposed, and then longitudinal again before they cease. This rugous portion of the tube is beset with mucous follicles, which secrete "the white." The oviduct, after contracting at a point called the *isthmus*, enlarges to a calibre sufficient to accommodate the egg in its shell; for this is the shell-forming part, homologous with the mammalian uterus (a sinister semi-uterus at least), lined with large villi, and beset with the follicles whose secretions calcify the egg-shell, and decorate it with pigment. The rest of the tube is vaginal, being merely the passage-way by which the perfected ovum is discharged into the cloaca, to be expelled *per anum*. The muscular walls of the oviduct consist of both circular and longitudinal unstriped fibres, like those of intestine, — the latter especially in upper portions and at the infundibulum, the former more conspicuously below, where they form a sort of *os tincæ* at the bottom of the calcific portion, and a kind of *sphincter vaginæ* at the end of the tube. A recognizable *clitoris* is developed in many birds.

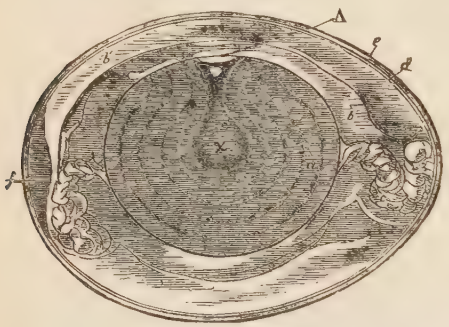


Fig. 110. — Hen's egg, nat. size, in section: from Owen, after A. Thompson. *A*, cicatricle or "tread," with its nucleus, of white germ-yelk, floating on surface of pale thin nutritive yelk, leading to central yelk-cavity, *x*; *a*, the yellow yelk-ball, deposited in the successive layers, forming a set of *halones*, and enveloped in the chalaziferous membrane which is spun out at opposite poles into the twisted strings, chalazæ, *c*, *c*; *b*, *b'*, successive investments of softer white albumen; *d*, membrana putaminis, the "soft shell" or egg-pod, between layers of which at the great end of the egg is the air space, *f*; *e*, the shell.

The deposition of the white and of the shell remains to be noticed. The first deposit upon the yelk-ball consists of a layer of dense and somewhat tenacious albumen, called the *chalaziferous membrane* (Gr. χάλαζα, *chalaza*, a tubercle, and Lat. *fero*, I bear). As the egg is urged along by the peristaltic action of the tube, it acquires a rotation about the axis of the tube; the successive layers of soft albumen it receives are deposited somewhat spirally; and the chalaziferous membrane is drawn out into threads at opposite poles of the egg. These threads, which become twisted in opposite directions during the rotation of the egg, are called *chalazæ;* they are the "strings," rather unpleasantly evident in a soft boiled egg, but serve the important office of mooring and steadying the yelk in the sea of white by adhesions eventually contracted with the membrane which immediately lines the shell. They are also intrusted with the duty of ballasting, or keeping the yelk right side up. For there is a "right side" to the yelk-ball, being that on which floats the cicatricle, or "tread." This side is also the lightest, the white yelk being less dense than the yellow; and the chalazæ are attached a little below the central axis. The result is, that if a fresh egg be slowly rotated on its long axis, the tread will rise by turning of the yelk-ball in the opposite direction, till, held by the twisting of the chalazæ, it can go no farther; when, the rotation being continued, the tread is carried under and up again on the other side, resuming its superior position as before. After all the spiral layers of soft white are laid on, a final covering of dense albumen is deposited at the isthmic part of the oviduct. This forms a tough tunic called the *membrana putaminis* (Lat.

putamen, a peel, rind), or "egg-pod"; it is the final envelope of such a "soft-shelled egg" as a hen drops when deprived of the lime required to enable her to secrete a hard shell. In the uterine dilatation of the oviduct a thick white fluid charged with earthy matter is exuded; this condenses upon the egg-pod and forms the shell. The composition of this earth is chiefly carbonate of lime (common chalk), with some carbonate of magnesia, and phosphates of both of these bases — thus like that of bone as to ingredients, but in very different proportions. The shell does not simply overlie the pod in a distinct sheet, but is intimately coherent, the microscopic crystals or other particles of the earthy matter being deposited in the matted fibrous texture of the pod. The connection is most intimate in fresh eggs; after a while, layers of the pod separate at the butt of the egg, forming the large air-space which every one has noticed in that situation. The shell being very porous, readily admits air. The air space enlarges during incubation, and the pod becomes more and more distinct from the shell, which latter also increases in porosity and fragility towards "full term." The rough or smooth appearance of an egg-shell, the pores which may be visible to the naked eye, and other physical characters, are due to the impression made upon it by the lining membrane of the "uterus." The superficial deposit of chalk is so heavy, in some cases, as those of cormorants, etc., that it may be scraped off without interfering with the texturally firm shell-substance underlying. All the coloration of egg-shells, which frequently makes them pretty objects, is simply the deposit of pigment granules in or upon the shell. Such deposit may be perfectly uniform, as it is in the bluish-green egg of a robin, for instance, but it is oftener spotty — either upon a white or a whole-colored ground. The browns and neutral tints are the usual colors, particularly a bright reddish-brown; the same, lying in instead of upon the shell, gives the grays, "lilacs," and "lavenders" so well known. In ptarmigan, the pigment is so heavily deposited that the egg comes out pasty on the surface; a sign of "fresh paint!" one must not disregard if he would not spoil the decoration.

Oviposition. — The energy and rapidity with which the processes involved in the manufacture of so complex a product as a bird's egg is now seen to be are extraordinary. A domestic fowl may lay an egg every day for an indefinite period. It is difficult to say how quickly an egg may ripen in the ovary; for, during the activity of that organ, several or many are to be found in all stages of immaturity, and the date of the initial impulse cannot well be determined. As there is probably but one egg at a time in the oviduct, the whole process of finishing off the yelk-ball with its chalaziform, soft albuminous, putaminous, and calcareous envelopes may go on in twenty-four hours, most of which time is consumed in the shell-formation. The number of eggs matured by the human female is or should be thirteen annually; this is no large number for many of the gallinaceous and anatine birds to deposit in about as many days. But a probable average number is five or six. Defeat of the procreative instinct from any accident is commonly a stimulation to renewed endeavors to reproduce; and very many birds rear two or three broods annually, though one clutch of eggs is the rule. Many, such as auks, petrels, and penguins, lay a single egg. Two eggs is the rule in humming-birds and pigeons. Three is normal to gulls and terns, though these often have but two. Four is the rule among the small waders of the limicoline groups. Some of the small *Oscines* lay over the average, having eight or ten; among these, the European sparrow, *Passer domesticus*, is probably the most prolific. The parasitic cuckoos are said to lay the relatively smallest eggs; that of the *Apertyx* is said to be the largest, weighing one fourth as much as the bird. The usual *shape* of an egg has given us the common names *oval*, *ovate*, and *ovoidal*, for the well-known figure. Some, as those of owls, woodpeckers, kingfishers, and others, more or less nearly approach a spherical shape. Eggs of grebes, herons, Totipalmate birds and various others are rather elliptical, or equal-ended, and narrow in proportion to their length. Eggs of the limicoline group are generally pyriform, — very broad at one end and narrow at the other. But

the eggs of all birds vary more in size and shape than some of the devotees of theoretical oölogy admit in their practice. The variation so well known in any breed of domestic fowl is scarcely above a normal rate. The short diameter, corresponding to the calibre of the oviduct, is less variable than the long axis; for when the quantity of food-yelk and white, upon which the difference in bulk depends, varies with the vigor of the individual, the scantiness or redundancy is expressed by the shortening or lengthening of the whole mass. The egg traverses the passage small end foremost, like a round wedge, with obvious reference to ease of parturition by more gradual dilatation of the outlet.

Germination. — Leaving now all the accessory parts of an egg, let us confine attention to the *germ-yelk*, or "tread," which is alone concerned in the germinative process. Recurring to the female *Dynamamœba*, consisting of granular protoplasm (vitellus) included in its cell-wall (vitelline membrane) and including its nucleus and nucleolus (germinal vesicle and germinal spot), we will trace it up to the time it begins to take shape as an embryo chick. At first, as I have observed before, it is like any other amœba; the first step of development is probably a retrograde one; for if there ensues, when the spermatozoa melt into the ovum, the result affirmed for mammalian ova, the original germinal vesicle and germinal spot *disappear*, and the whole content of the ovum proper is simply a homogeneous mass of granular protoplasm. In this retrograde step, the organism, at the lowest possible round of the ladder of evolution, is called a *monerula*. The germinal vesicle and spot, however, are speedily reconstructed, and the ovum looks precisely as it did before. But observe that the actual difference is enormous; for it now consists of the blended substance of the original ovum and of the spermatozoa; and in this duplex or bisexed state, before any further step is taken, the creature is called a *cytula*, — the parent cell of the entire future organism. In the former state it could reproduce nothing, not even itself; for it is the strange physiological law of a *Dynamamœba* that it cannot reproduce like an ordinary cell, but must evolve an entire organism, like both of those two whose vital forces it concentrates, summarizes, and embodies, — or nothing.

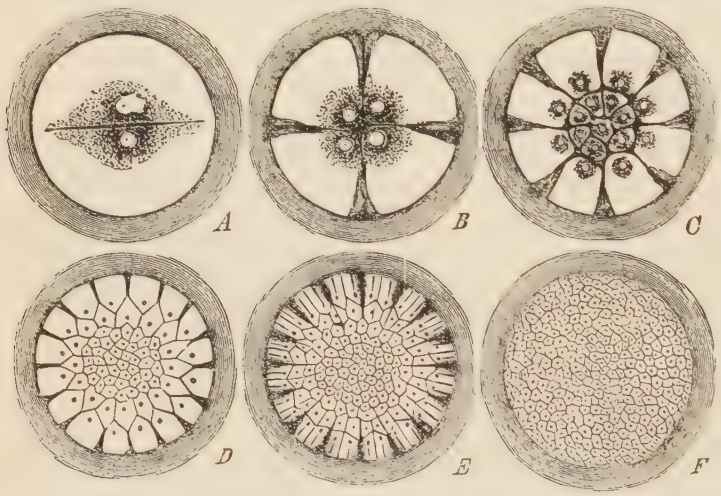


FIG. 111. — Segmentation of the vitellus by discoidal cleavage, diagrammatic, × about 10 times, after Haeckel. Only the "tread," cicatricle, or germ-yelk (figs. 109, *b*, 110, *A*) is represented, as no other part of the whole yelk-ball undergoes the process. *A*, separation into 2; *B*, into 4; *C*, into 16, by 8 radial and 1 concentric furrow; *D*, into many parts, by 16 radial and about 4 concentric furrows; *E*, 64 radial and about 6 concentric furrows; *F*, the whole tread broken up into a mulberry-mass (*morula*) of cells.

The first change in the parent-cell is that by which it becomes broken up into a mass of cells, each of which is just like itself. This process is called *segmentation of the vitellus;* each one of the numerous resulting cells is called a *cleavage-cell*. The nucleus of the parent-cell divides into two; each attracts its half of the yelk; the halves furrow apart and there are now

two cleavage-cells in place of the one parent-cell. A furrow at right angles to the first, and redivision of the nuclei, results in *four* cleavage-cells. Radiating furrows intermediate to the first two bisect the four cells, and would render *eight* cells, were not these simultaneously doubled by a circular furrow which cleaves each, with the result of sixteen cleavage-cells. So the subdivision goes on until the parent-cell becomes a mass of cells. This particular kind of cleavage, by radiating and concentric furrowing, is called *discoidal*, and the resulting heap of little cells assumes the figure of a thin, flat, circular disc. Segmentation of the vitellus, in whatever manner it may go on, results in a mulberry-like mass of cleavage-cells; and the original cytula has become what is called a *morula*. This process and result are clearly shown in fig. 111, *A–F*.

The morula or mulberry-massed germ of which the "tread" of a bird's egg at this moment consists increases by multiplication of cells, and the disc is lifted a little away from the mass of yellow food-yelk upon which it rests, like a watch-crystal from the face of a watch. This disposition of the greatly multiplied cells in a *layer* and their coherence forms of course a *membrane*, — the *blastodermic membrane*, or *blastoderm*, fig. 112, *B*, *b*. The cavity between the blastoderm and the mass of food-yelk is called the *cleavage cavity*, *s*. At the stage when the blastodermic membrane and cleavage-cavity are formed, the germ is called a *blastula*, or *germ-vesicle*,[1] and the process by which the morula becomes a blastula is called *blastulation*. Next, from the thickened rim, *w*, of the watch-crystal-like blastula a layer of large *entoderm* cells, fig. 112, *C*, *i*, separates, and grows toward the centre: when it gets there, of course the original cleavage-cavity, *s*, is shut off from the surface of the food-yelk; a second crystal having grown under the first one. The second adheres to the first, obliterating the original cleavage-cavity; the germ is now obviously *two-layered;* the rising of the inner layer to meet the outer results in a cavity between itself and the food-yelk, *D*, *d*. This cavity exactly resembles the original cleavage-cavity, but it is a very different thing, being the primitive *intestinal cavity*. The blastula, or germ-vesicle, has become converted into a *gastrula*, by the invaginating process just described, known as *gastrulation*. The gastrula of a bird has the circular discoidal form which causes it to be termed a *discogastrula*. This process of forming a single blastodermic layer, with a cleavage-cavity (blastula, or true germ-vesicle), then two blastodermic layers, with obliteration of the cleavage-cavity and substitution of a primitive intestinal cavity (gastrula), is common to all animals which consist of more than single cells, under various modifications and disguises; the process described is that occurring in meroblastic eggs which have a discoidal cleavage and form a discogastrula.[2]

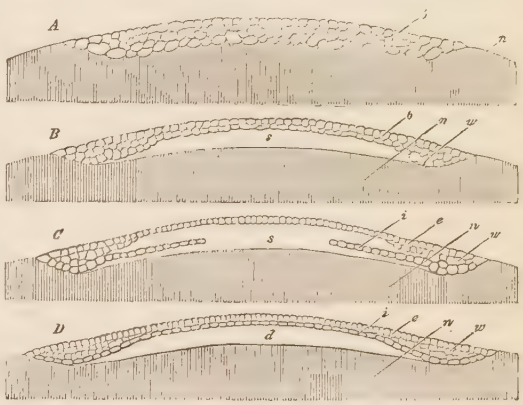


FIG. 112. — Further development of hen's egg; after Haeckel: *A*, the mulberry mass of cleavage cells, *b*, same as seen on top in fig. 111, *F*, here viewed in profile in section, resting upon *n*, the simply-shaded part of the figure, to represent conventionally the mass of food-yelk. *A*, morula stage (as before); *B*, blastula stage, the mass of cells, *b*, forming the blastoderm, uplifted from the food-yelk, leaving the cleavage-cavity, *s*; *w*, the thickened rim of the germ-disc; *C*, the blastula in process of inversion, by which a layer of entoderm-cells, *i*, growing from periphery to centre, will apply itself to the layer of exoderm-cells, *e*, obliterating the cleavage-cavity, *s*; *D*, the disc-gastrula completed, by union of entoderm, *i*, with exoderm, *e*, leaving the primitive intestinal cavity, *d*, which is quite similar in appearance to the cleavage cavity, *s*, but morphologically quite different.

[1] Not to be confounded with the original "germinal vesicle" of the parent-cell, which long since disappeared

[2] The so-called "germ-vesicle" of the holoblastic mammalian egg is subsequent to gastrulation, not prior, and is therefore not a blastula proper.

What we have got now is a tread or germ consisting of a circular concavo-convex disc of two layers of blastoderm, resting by its rim upon the great yellow ball of food-yelk, from which it is separated by a cavity, as a watch-crystal from its face. All these changes, up to completion of gastrulation, may go on *before the egg is laid*, the tread of a perfectly fresh egg being already a multicellular discogastrula. Since the earlier stages of the embryo (cytula, morula, blastula, and gastrula) are actually accomplished while the egg is still in the body of the parent, the analogy of the oviduct to uterus, etc., as well as its strict homology to the parts of a müllerian duct so named, is not so fanciful as some appear to think. The outer of the two blastodermic layers is the *ectoderm* or *epiblast*, *C* or *D*, *e*; the inner is the *endoderm* or *hypoblast*, *i*. By multiplication of cells between the two arises the *mesoblast*. The mesoblastic layer of cells subsequently splits into two, of which the outer is the *somatopleura*, or body layer, the inner the *splanchnopleura* or visceral layer. The two-layered germ has then become four-layered. Up to the time of formation of four layers, the cells are all alike, or only differ slightly in size, color, or consistency. Now, however, ensues that marvellous process by which the indifferent cells of the blastodermic layers are to become *differentiated in form and specialized in function*,—a sort of division-of-labor system in the infant colony of cells, by which some are to learn to move, others to digest, others to procreate, others to think and feel, with corresponding modifications of form by which are generated the *Osteamœbæ*, *Myamœbæ*, *Neuramœbæ*,—the bone-cells, muscle-cells, nerve-cells, and all others of the complex organism which is in a few days to come into being from such simple beginnings. This of course opens up the whole field of embryology, which we cannot here enter upon. I will only add, that from the epiblast is derived the integument, and its inversions, as those of the eye and ear, and the brain and spinal chord. From the hypoblast is derived the lining of the alimentary canal and of its annexes and offsets, as liver, lungs, etc. The rest of the embryo comes from the mesoblast, and most of it from the somatopleural layer. The fissure between the two layers of the mesoblast becomes the great pleuro-peritoneal cavity.

In explaining the early embryo, I have closely followed the great German morphologist, Haeckel; and the illustrations are from the same high source.

Incubation. — To induce the wonderful metamorphoses just hinted at, it is only necessary to keep a bird's egg at a pretty even temperature of about 100° F. Nearly all birds secure this result by the process of *incubation*. In many cases the sun's rays relieve the parent of some part of the duty. In a few, the heat evolved from vegetable ferment or decomposition is utilized for the same purpose. This seems to be the case to some extent with grebes; but these incubate. "The exception to the rule of incubation is given by the Megapodial birds of the Australasian Islands. A huge mound of decaying vegetable matter is raised; the eggs are deposited vertically in a circle at a certain depth, near the summit, and the chick is developed with the aid of the heat of fermentation. The large size of the egg relates to affording a supply of material sufficing for an unusually advanced state of development of the chick at exclusion; whereby it has strength to force its way to the surface of the hatching-mound, with wings and feathers sufficiently developed to enable it to take a short flight to the nearest branch of an overshadowing tree" (Owen). The period of incubation has been ascertained with precision for few birds; it is known to range from ten days (perhaps less), as in case of the wren, to fifty or sixty for the ostrich. The female is usually the sitter. Frequently both sexes incubate in turn; such unnatural care for the young by the male is termed *double monogamy*. In most or all *Ratitæ*, in the family *Phalaropodidæ*, and some other Limicoline genera, the male incubates. Most birds attend to their own eggs; many cuckoos (*Cuculidæ*) and the species of *Molothrus*, are parasitical, laying in the nests of other birds, which are thus forced to become foster-parents of alien offspring, generally to the destruction of their own. This seems to result from some peculiarity of the egg-laying process, which does not permit several eggs

to be incubated and hatched simultaneously. It is not so unusual among American cuckoos as generally supposed. The degree of development to which birds attain in the egg has been already discussed (p. 88). They break the shell by pecking at it, and struggling; for the former operation the bill is often tempered at the tip by a hard knob which is afterward absorbed. The necessity of providing a receptacle for eggs, in which they may be incubated, results in *nidification* or nest-building; and the extraordinary taste and ability many birds display in this matter, as well as the wide range of their habitudes, furnishes one of the most delightful departments of ornithology, called *caliology* (Gr. καλιά, *kalia*, a bird's nest; see p. 54, note). Many birds burrow in the ground; others in trees; the most beautiful and elaborate nests are furnished by various members of the *Oscines*, the weaver-birds of Africa (*Ploceidæ*) probably taking the lead. The male sometimes constructs his own "nest" apart from that in which the female incubates. "Certain conirostral *Cantores* still practise in the undisturbed wilds of Australia the formation of marriage-bowers distinct from the later-formed nesting-place. The satin bower-bird (*Ptilonorhynchus holosericeus*), and the pink-necked bower-bird (*Chlamydodera maculata*), are remarkable for their construction on the ground of avenues, over-arched by long twigs or grass-stems, the entry and exit of which are adorned by pearly shells, bright-colored feathers, bleached bones, and other decorative materials, which are brought in profusion by the male, and variously arranged to attract, as it would seem, the female by the show of a handsome establishment" (Owen). The extraordinary nests of the *Crotophaga*, used in common by a colony of the birds, are noted at p. 471. "Edible birds'-nests," constructed by swifts of the genus *Collocalia*, consist chiefly of inspissated saliva. Perhaps the most remarkable of all the receptacles of eggs is that which the penguin makes of its own body, the egg being carried in a sort of pouch formed by the integument of the belly, something like that of a marsupial mammal.

§ 5. DIRECTIONS FOR USING THE ARTIFICIAL KEYS.

These "Keys" differ from natural analyses in being wholly arbitrary and artificial. They are an attempt to take the student by a "short cut" to the name and position in the ornithological system of any specimen of a North American bird he may have in hand and desire to *identify*. The plan has been much used in Botany, though seldom if ever employed for a whole Fauna, before the original edition of this work. It will serve a good purpose, rightly used; but it must be remembered there *is no* "royal road to learning"; nobody can be smuggled into sound erudition, either. Nor must too much be expected of me here; I can take the student nowhere until he has learned the difference between the head and the tail of a bird, at any rate. That is what the preceding pages undertake to teach; but, until such technicalities have been mastered, progress in ornithology is out of the question.

The original "Key to the Genera" proved scarcely so satisfactory as I hoped it would be. It undertook too much, to conduct the student at once down to the intricacies of the very many modern genera, not all of which can by any possibility be characterized intelligibly in a line of type. I have probably simplified and expedited matters by preparing on the same plan Keys to the Orders and Sub-orders, and to the Families. Then in the body of the work, under each head, further analyses are given when such seems to be required, — of families under their orders or sub-orders, of genera under their families, and of species under their genera. These ulterior analyses are for the most part rather natural than artificial, though I never hesitate to seize upon *any* character that may furnish the desired clue to identification.

The artificial Keys immediately following will take the student to the *families*, with reference to the page of the work where such groups come; on turning to which, further analyses

will be found, generally down to species and even varieties. They are to be used as follows (*after the preceding lessons have been learned*): —

We have in hand a bird we do not know, and the name of which we wish to ascertain. Suppose it to be that common species which builds the nest of mud upon the bough of the apple-tree and lays greenish-blue eggs. To what *family* does it belong?

The Key opens with an arbitrary division of our birds according to the number and position of their toes. Our specimen, we see, has four toes, three in front, one behind. It therefore comes under IV. Going to IV., we read:

Hind toe — inserted above the level of the rest, etc.
— not inserted above the level of the rest. . . . (Go to B.)

Our specimen has the hind toe not inserted above the level of the rest. Going to B, we find five alternatives. Our bird presents no one of the special characters of the first four alternatives, and this determined takes us to *g*. There we find:

(*g*) Primaries — 10; the 1st (never spurious), etc.
— 10; the 1st (spurious or), etc. . . . (Go to *i*)
— 9; the 1st (never spurious), etc.

In this case the bird has obviously a spurious first primary, not nearly two-thirds as long as the longest. Going to *i*; —

(*i*) Tarsus — "booted"; wings — shorter than, etc.
— longer than tail; tail — double rounded.
— not double rounded. . . . . TURDIDÆ, p. 240.

Thus (provided we have taken the trouble to inform ourselves what "spurious first primary" and "booted tarsus" mean), the key conducts to a family, by presenting in succession certain *alternatives*, on meeting with each of which, we have only to determine which one of the two or more sets of characters agrees with those afforded by our specimen. There will not, it is believed, be any trouble in determining whether a given character *is so*, or *is not so*, since only the most tangible, definite, and obvious features have been selected in framing the key. After each determination, either the name of a family is encountered, or else a reference-letter leads on to some new alternative, until by a gradual process of elimination the proper family is reached. After a few trials, with specimens representing different groups, the process will be shortened, for the main divisions will have been learned; still the student must be careful how he strikes in anywhere except at the beginning, for a false start will soon set him hopelessly adrift. The key has been tested so thoroughly that there is little danger of his running off the track except through carelessness, or misconception of technical terms; but there is no excuse for the former, and the latter may be obviated by the Glossary at the end of the book, and especially the foregoing General Ornithology, § 3, which should be consulted when any doubt arises. Time spent upon the preliminary lessons will be time saved in the end.

At page 240, as indicated, the family *Turdidæ* is fully characterized, and its sub-families and genera are analysed. The bird in hand should answer all the characters of the family and those of one of the sub-families, *Turdinæ*, and one of the genera, *Turdus*. The analysis of the species of *Turdus* should show the specimen to be *Turdus migratorius*, the Robin. Under the head of that species, No. 1 of the List, will be found a fair description and various other particulars.

If there be any difficulty in going at once to the family, the student may try the key to the orders and sub-orders, and get on the track in that way.

Directions for measurement have already been given (p. 24). In comparing measurements made with those given in the Synopsis, absolute agreement must not be expected; individual specimens vary too much for this. It will generally be satisfactory, if the discre-

pancy is not beyond certain bounds. A variation of, say, five per cent. may be safely allowed on birds not larger than a robin: from this size up to that of a crow or hawk, ten per cent.; for larger birds even more. Some birds vary up to twenty or twenty-five per cent., in their total length at least. So if I say of a sparrow for instance, "length six inches," and the specimen is found to be anywhere between five and three-fourths and six and one-fourth, it will be quite near enough. But the relative proportions of the different parts of a bird are much more constant, and here less discrepancy is allowable. Thus "tarsus longer than the middle toe," or the reverse, is often a matter of much less than a quarter of an inch; and as it is upon just such nice points as this that a great many of the generic analyses rest, the necessity of the utmost accuracy in measuring, for the use of the keys, becomes obvious. When I find it necessary to use the qualification "about" (as, "bill *about* = tarsus") I probably never mean to indicate a difference of more than five per cent. of the length of the part in question.

It may be well to call attention to the fact, that most persons unaccustomed to handling birds are liable to be deceived in attempting to *estimate* a given dimension; they generally make it out *less* than measurement shows it to be. This seems to be an optical effect connected with the solidarity of the object, as is well illustrated in drawing plates of birds, which, when made exactly of life-size, always look larger than the original, on account of the flatness of the paper. The ruler or tape-line, therefore, should always be used, and particularly in those cases where analyses in the key rest upon dimensions. It is hardly necessary to add, that in taking, approximately, the total length from a prepared specimen, regard should be had for the "make-up" of the skin. A little practice will enable one to determine pretty accurately how much a skin is stretched or shrunken, and to make the due allowance in either case.

The measurements used in this work are all in English inches and decimals.

There are probably no signs or abbreviations not self-explanatory or not already explained in "Field Ornithology."

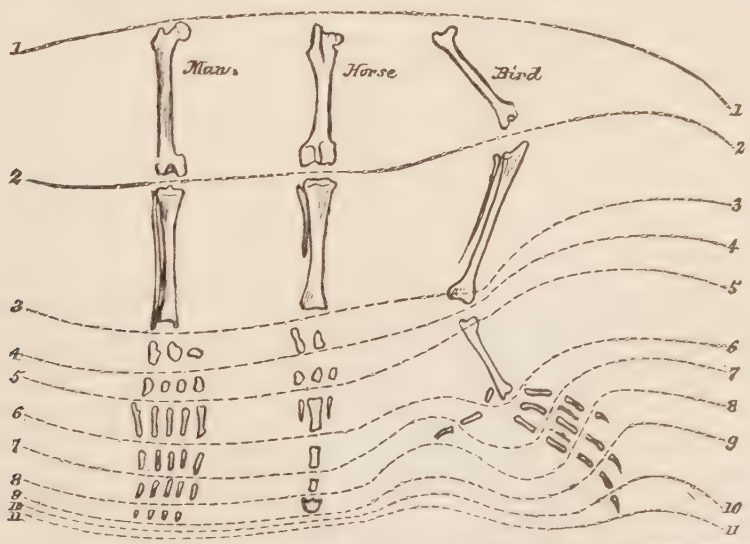


FIG. 112 *bis*. — Diagram of corresponding segments of hind limbs of man, horse, and bird. The lines 1-11 are *isotomes*, cutting the limbs into morphologically equal parts, or *isomeres*.

ARTIFICIAL KEY TO THE ORDERS AND SUBORDERS.

Page

I. Toes 3; 2 in front, 1 behind . . . . . *Piciformes of* Picariæ 444

II. Toes 3; 3 in front. Toes — cleft or semipalmate . . . . . Limicolæ 596
— palmate. Nostrils — tubular . . . . . Longipennes 732
— not tubular . . . . . Pygopodes 787

III. Toes 4; 2 in front, 2 behind. Bill — cered and hooked . . . . . Psittaci 494
— neither cered nor hooked. Tail feathers — 8 or 10
Cuculiformes of Picariæ 444
— 12 *Piciformes of* Picariæ 444

IV. Toes 4; 3 in front, 1 behind.
Toes — syndactyle . . . . . *Cuculiformes of* Picariæ 444
— totipalmate (all four full-webbed) . . . . . Steganopodes 718
— palmate. Bill — curved up . . . . . Limicolæ 596
— not curved up — lamellate . . . . . Lamellirostres 677
— not lamellate. Hallux — lobate . . . . . Pygopodes 787
— not lobate . . Longipennes 732
— lobate. Tail — rudimentary . . . . . Pygopodes 787
— perfect. — A horny frontal shield . . . . . Alectorides 665
— No frontal shield . . . . . Limicolæ 596
— semipalmate; joined by evident movable basal web (go to **A**).
— cleft to the base or there immovably coherent (go to **B**).

A. Hind toe — elevated. Tibiæ — feathered below. Nostrils — perforate . . . *Cathartides of* Raptores 496
— imperforate. Gape — reaching below eye
Cypseliformes of Picariæ 444
— not reaching below eye
Gallinæ 571
— naked below. Nostrils — perforate . . . . . Alectorides 665
— imperforate. Tarsi — scutellate in front
Limicolæ 596
— reticulate. Head — bald
Herodiones 647
— feathered
Limicolæ 596
— not elevated. Tibiæ — naked below . . . . . Herodiones 647
— feathered below. Bill — cered and hooked . . . . . Raptores 496
— not cered. Nasal — membrane soft Columbæ 561
— scale hard . Gallinæ 571

B. Hind toe — elevated. Gape — reaching below eye . . . . . *Cypseliformes of* Picariæ 444
— not below eye. 1st primary — emarginate or about = 2d . . Limicolæ 596
— not emarginate and shorter than 2d
Alectorides 665
— not elevated. Nostrils — opening beneath soft swollen membrane . . . . . Columbæ 561
— otherwise. Bill — cered and hooked . . . . . Raptores 496
— otherwise. Secondaries — only six
Cypseliformes of Picariæ 444
— more than six (go to **a**).

a. Primaries — 10; 1st more than ⅔ as long as the longest . . . . . *Clamatores of* } Passeres 238
— 10; 1st not ⅔ as long as the longest } . . . . . *Oscines of* }
— 9 only . . . . . }

ARTIFICIAL KEY TO THE FAMILIES.

Page

TOES 3, — 2 IN FRONT, 1 BEHIND . . . . . PICIDÆ 477
TOES 3, — 3 IN FRONT. (Go to **II.**)
TOES 4, — 2 IN FRONT, 2 BEHIND. (Go to **III.**)
TOES 4, — 3 IN FRONT, 1 BEHIND. (Go to **IV.**)

II. [TOES 3, — 3 IN FRONT.]

Toes — completely webbed. Nostrils — tubular (Albatrosses) . . . . . PROCELLARIIDÆ 773
— not tubular (Auks, &c.) . . . . . ALCIDÆ 797
— incompletely or not webbed. Legs — about as long as wings. Bill subulate (Stilt) RECURVIROSTRIDÆ 609
— much shorter than wings (go to **a**).
(**a**) Tarsus — scutellate in front, about as long as bill (Sanderling) . . . . . SCOLOPACIDÆ 614
— reticulate in front — shorter than red chisel-like bill (Oyster-catcher) . HÆMATOPODIDÆ 606
— longer than bill (Plovers) . . . . . CHARADRIIDÆ 597

III. [TOES 4, — 2 IN FRONT, 2 BEHIND.]

Bill — cered and strongly hooked. Tarsus granulated (Parrot) . . . . . PSITTACIDÆ 496
— not cered; inner hind toe — 3-jointed; Plumage iridescent (Trogon) . . . . . TROGONIDÆ 468
— 2-jointed; — tail of — 8 or 10 soft feathers (Cuckoos, &c.) . . CUCULIDÆ 470
— 12 (apparently only 10) rigid acuminate feathers
(Woodpeckers) . . . . . PICIDÆ 477

IV. [TOES 4, — 3 IN FRONT, 1 BEHIND.]

HIND TOE — INSERTED ABOVE THE LEVEL OF THE REST (AND ALWAYS SHORTER THAN THE SHORTEST FRONT TOE). (Go to **A.**)
— NOT INSERTED ABOVE THE LEVEL OF THE REST (AND GENERALLY, BUT NOT ALWAYS, NOT SHORTER THAN THE SHORTEST FRONT TOE). (Go to **B.**)

A. [*The hind toe elevated.*]

Feet — TOTIPALMATE (*all 4 toes webbed; hind toe semi-lateral and barely elevated*). (Go to **A.**)
— PALMATE (3 *front toes full-webbed, hind toe well up, simple or lobed or connected by slight webbing to base only of inner toe*). (Go to **B.**)
— LOBATE (3 *front toes partly webbed or not, and conspicuously bordered with plain or scalloped membranes; hind toe free, and simple or lobed*). (Go to **C.**)
— SEMIPALMATE (2, *or* 3, *front toes webbed at base only by small yet evident membrane; hind toe well up, simple*). (Go to **D.**)
— SIMPLE (*front toes with no evident membranes; hind toe well up, simple*). (Go to **E.**)
(**A.**) Tarsus — feathered, partly; tail deeply forked; bill epignathous (Frigate-bird) . . . . TACHYPETIDÆ 730
— naked; bill — > tail, hooked at tip, furnished with enormous pouch (Pelicans) PELECANIDÆ 721
— < tail; throat — feathered; middle tail feathers filamentous (Tropic-birds)
PHAETHONTIDÆ 731
— naked; tail — pointed, soft; tomia subserrate (Gannets) SULIDÆ 720
— rounded, stiff; bill — paragnathous (Anhinga)
PLOTIDÆ 729
— epignathous (Cormorants)
PHALACROCORACIDÆ 723

Page

(B.) Bill — curved up, extremely slender and acute (Avocet) . . . . . RECURVIROSTRIDÆ 609
— bent abruptly down, very stout, lamellate (Flamingo) . . . . . PHŒNICOPTERIDÆ 678
— lamellate; mostly membranous, with nail at end (Swans, Geese, Ducks, &c.) . . . . ANATIDÆ 679
— not lamellate; nostrils — tubular; hind toe very small (Petrels) . . . . . PROCELLARIIDÆ 773
— not tubular; hind toe — free, not lobed (Gulls and Terns) . . LARIDÆ 733
— not free, lobed (Loons) . . . . . COLYMBIDÆ 789
(C.) Tail — rudimentary; lores naked (Grebes) . . . . . PODICIPEDIDÆ 792
— perfect; forehead — covered with a horny shield (Coots) . . . . . RALLIDÆ 669
— feathered (Phalaropes) . . . . . PHALAROPODIDÆ 612
(D.) Mid-claw — pectinate; 4th toe 4-jointed; plumage lax (Goatsuckers) . . . . . CAPRIMULGIDÆ 447
— not pectinate; hind toe — versatile; plumage compact (Swifts) . . . . . CYPSELIDÆ 455
— not versatile; head — naked (go to **b**).
— feathered (go to **c**).
(b.) Nostrils — imperforate; naked leg and foot shorter than tail (Turkey) . . . . MELEAGRIDIDÆ 576
— perforate; naked leg and foot — shorter than tail (Turkey-buzzards) . CATHARTIDÆ 557
— longer than tail (Cranes) . . . . . GRUIDÆ 666
(c.) Nostrils — feathered, or scaled, in deep fossa of stout hard bill . . . . . TETRAONIDÆ 576
— not feathered nor scaled, in groove of softish bill; tarsus — reticulate (Plover) CHARADRIIDÆ 597
— scutellate in front (Snipe, &c.)
(E.) Wing — spurred . . . . . PARRIDÆ 669
— not spurred; forehead — covered with a horny shield (Gallinules) . . . . . RALLIDÆ 669
— feathered; length — 2 feet or more . . . . . ARAMIDÆ 667
— under 2 feet; 1st primary — attenuate (Woodcock) . . . SCOLOPACIDÆ 614
— not attenuate — much shorter than 2d (Rails) RALLIDÆ 669
— about equal to 2d (Snipe, &c.) SCOLOPACIDÆ 614 or HÆMATOPODIDÆ 606

B. [*The hind toe not elevated.*]

TOES SYNDACTYLOUS; tibiæ naked below; bill straight, acute (Kingfishers) . . . . . ALCEDINIDÆ 468
TIBIÆ NAKED BELOW. (Go to **d.**)
NOSTRILS OPENING BENEATH SOFT SWOLLEN MEMBRANE. (Go to **e.**)
BILL HOOKED AND FURNISHED WITH A CERE. (Go to **f.**)
BIRDS WITHOUT THE ABOVE CHARACTERS. (Go to **g.**)
(d.) Middle claw — pectinate (Herons) . . . . . ARDEIDÆ 654
— simple; tarsus — scutellate in front (Ibises) . . . . . IBIDIDÆ 648
— reticulate; bill — flat, spoon-shaped (Spoonbill) . PLATALEIDÆ 651
— not flat, stout tapering (Wood Ibis) CICONIIDÆ 652
(e.) Bird over 18 inches long, greenish (Texan Guan) . . . . . CRACIDÆ 572
Birds under 18 inches long (Pigeons) . . . . . COLUMBIDÆ 562
(f.) Eyes — lateral, not surrounded by a disc; nostrils *in* the cere (Hawks, Eagles, &c.) . FALCONIDÆ 519 or PANDIONIDÆ 556
— anterior; face more or less disc-like; nostrils at edge of cere (Owls); middle claw — simple STRIGIDÆ 502
— jagged ALUCONIDÆ 500
(g.) PRIMARIES — 10; the 1st (never spurious) *always more than ⅔ as long as longest* (go to **h**).
— 10; the 1st (spurious or) *at most not ⅔ as long as longest* (go to **i**).
— 9; the 1st (*never spurious*) of variable length (go to **k**).
(h.) Tail — 12-feathered; tarsal envelope irregular (Flycatchers) . . . . . TYRANNIDÆ 428
— 10-feathered; secondaries — only 6; bill subulate (Humming-birds) . . . TROCHILIDÆ 458
— more than 6; bill small, very short (Swifts) . . CYPSELIDÆ 455
(i.) Tarsus — "booted"; wings — shorter than tail, both much rounded; plumage very lax CHAMÆIDÆ 262
— longer than tail; tail — double-rounded . . . . . AMPELIDÆ 325
— not double-rounded (Thrushes, &c.) TURDIDÆ 240
— scutellate; nostrils — concealed; bill — strongly epignathous, toothed and notched (Shrikes) LANIIDÆ 336
— paragnathous; — over 7 inches long (Crows and Jays) CORVIDÆ 414
— not 7 inches; bill — nearly = head (Nuthatches) SITTIDÆ 269
— scarcely or not ½ = head (Tits) PARIDÆ 263

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— **exposed**; length — over 9 inches; color brown or blue . CORVIDÆ 414
— 7–8 inches; crested; ♂ glossy black AMPELIDÆ 325
—4⅜–6¼ inches; bill distinctly hooked; tail soft, without black VIREONIDÆ 329
—4½–5½ inches; bill slender, curved, tail stiff, acute CERTHIIDÆ 272
— Birds without these characters; rictus — bristled TURDIDÆ 240
— unbristled TROGLODYTIDÆ 273

(k.) **Tarsus** — scutelliplantar; hind claw straight (Larks) . . . . . ALAUDIDÆ 280
— laminiplantar; bill — metagnathous, both mandibles falcate, their points crossed FRINGILLIDÆ 339
— paragnathous, tomia of up. mand. toothed or lobed near middle (Tanagers) TANAGRIDÆ 317
— epignathous, notched and hooked at tip. Length 5¼–6½ VIREONIDÆ 329
— various. Quills — tipped with red horny appendages; head crested AMPELIDÆ 325
— not appendaged; bill — fissirostral (go to **l**).
— dentirostral or tenuirostral (go to **m**).
— conirostral (go to **n**).

(l.) Bill triangular-depressed, about as wide at base as long, gape twice as long as culmen, reaching about opposite eyes, tarsus not longer than outer toe and claw (Swallows) . . HIRUNDINIDÆ 319

(m.) Longest secondary nearly reaching end of primaries in closed wing; hind claw (usually) little curved, nearly twice as long as middle claw (Titlarks) . . . . . MOTACILLIDÆ 283
Longest secondary not nearly reaching end of primaries in closed wing; hind claw well curved, not nearly twice as long as middle claw (Warblers, &c.) . CŒREBIDÆ 317, or SYLVICOLIDÆ 287

(n.) Bill usually thick, stout, and with evident angulation of the commissure . . . . . ICTERIDÆ 399
or[1] FRINGILLIDÆ 339

[1] *Note.* — These two families *cannot* be concisely distinguished. ICTERIDÆ contains the blackbirds, orioles, meadow starlings, bobolinks, and cowbirds. FRINGILLIDÆ, our largest family, includes all kinds of grosbeaks, buntings, linnets, finches, and sparrows.

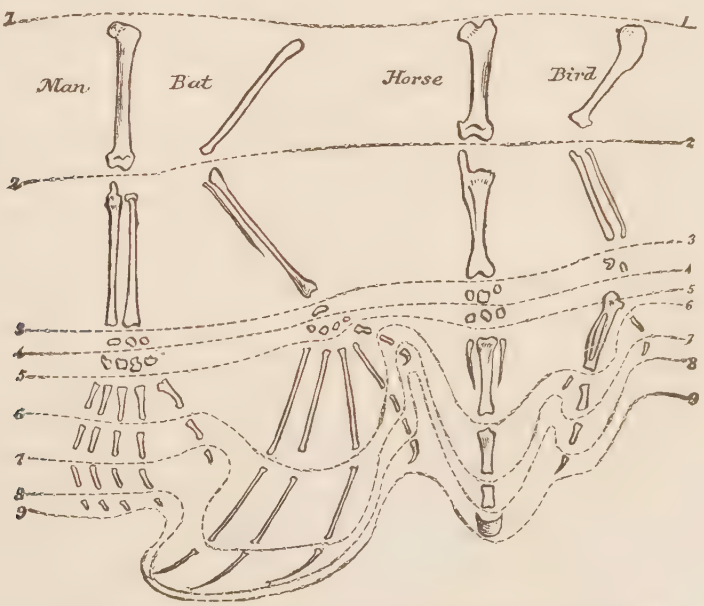

FIG. 112 *ter*. Diagram of fore limbs of man, bat, horse, and bird. The lines 1–9 are *isotomes*, cutting the limbs into morphologically equal parts, or *isomeres*.

TABULAR VIEW OF THE GROUPS HIGHER THAN GENERA

ADOPTED IN THIS WORK FOR THE

CLASSIFICATION OF NORTH AMERICAN BIRDS.

Subclass CARINATÆ: Carinate Birds.

Orders (13).	Suborders (20).	Families (63).	Subfamilies (77).
I. PASSERES	1. Oscines	1. *Turdidæ*	1. Turdinæ.
			2. Mimina.
			3. Cinclinæ.
			4. Saxicolinæ.
			5. Regulinæ.
			6. Polioptilinæ.
		2. *Chamæidæ* (?)	
		3. *Paridæ*	7. Parinæ.
		4. *Sittidæ*	
		5. *Certhiidæ*	8. Certhiinæ.
		6. *Troglodytidæ*	9. Campylorhynchinæ.
			10. Troglodytinæ.
		7. *Anorthuridæ*	11. Calandritinæ.
			12. Alaudinæ.
		8. *Motacillidæ*	13. Motacillinæ.
			14. Anthinæ.
		9. *Sylvicolidæ*	15. Sylvicolinæ.
			16. Icteriinæ.
			17. Setophaginæ.
		10. *Cœrebidæ*	
		11. *Tanagridæ*	
		12. *Hirundinidæ*	
		13. *Ampelidæ* (?)	18. Ampelinæ.
			19. Ptilogonatinæ.
			20. Myiadestinæ.
		14. *Vireonidæ*	
		15. *Laniidæ*	21. Laniinæ.
		16. *Fringillidæ*	?
		17. *Icteridæ*	22. Agelæinæ.
			23. Sturnellinæ.
			24. Icterinæ.
			25. Quiscalinæ.
		18. *Corvidæ*	26. Corvinæ.
			27. Garrulinæ.
		19. *Sturnidæ*	28. Sturninæ.
	2. Clamatores	20. *Tyrannidæ*	29. Tyranninæ.
II. PICARIÆ (?)	3. Cypselliformes	21. *Caprimulgidæ*	30. Caprimulginæ.
		22. *Cypselidæ*	31. Cypselinæ.
			32. Chæturinæ.
		23. *Trochilidæ*	33. Trochilinæ.
	4. Cuculiformes ?	24. *Trogonidæ*	34. Trogoninæ.
		25. *Alcedinidæ*	35. Alcedininæ.
		26. *Cuculidæ*	36. Crotophaginæ.
			37. Saurotherinæ.
			38. Coccyginæ.
	5. Piciformes	27. *Picidæ*	

Orders (13).	Suborders (20).	Families (63).	Subfamilies (77).
III. PSITTACI	?	28. *Psittacidæ*	39. Arinæ.
IV. RAPTORES	6. Striges	29. *Aluconidæ*	
		30. *Strigidæ*	40. Striginæ?
			41. Buboninæ?
	7. Accipitres	31. *Falconidæ*	42. Circinæ.
			43. Milvinæ.
			44. Accipitrinæ.
			45. Falconinæ.
			46. Polyborinæ.
			47. Buteoninæ.
		32. *Pandionidæ*	
	8. Cathartides	33. *Cathartidæ*	
V. COLUMBÆ	9. Peristeræ	34. *Columbidæ*	48. Columbinæ.
			49. Zenaidinæ.
			50. Starnœnadinæ.
VI. GALLINÆ	10. Peristeropodes	35. *Cracidæ*	51. Penelopinæ.
	11. Alectoropodes	36. *Meleagrididæ*	
		37. *Tetraonidæ*	52. Tetraoninæ.
			53. Odontophorinæ.
VII. LIMICOLÆ	?	38. *Charadriidæ*	54. Charadriinæ.
			55. Aphrizinæ ?
		39. *Hæmatopodidæ*	56. Hæmatopodinæ.
			57. Strepsilainæ.
		40. *Recurvirostridæ*	
		41. *Phalaropodidæ*	
		42. *Scolopacidæ*	
VIII. HERODIONES	12. Ibides	43. *Ibididæ*	
		44. *Plataleidæ*	
	13. Pelargi	45. *Ciconiidæ*	58. Tantalinæ.
			59. Ciconiinæ.
	14. Herodii	46. *Ardeidæ*	60. Ardeinæ.
			61. Botaurinæ.
IX. ALECTORIDES	15. Gruiformes	47. *Gruidæ*	
		48. *Aramidæ*	
	16. Ralliformes	49. *Parridæ*	
		50. *Rallidæ*	62. Rallinæ.
			63. Gallinulinæ.
			64. Fulicinæ.
X. LAMELLIROSTRES	17. Odontoglossæ	51. *Phœnicopteridæ*	
	18. Anseres	52. *Anatidæ*	65. Cygninæ.
			66. Anserinæ.
			67. Anatinæ.
			68. Fuligulinæ.
			69. Merginæ.
XI. STEGANOPODES		53. *Sulidæ*	
		54. *Pelecanidæ*	
		55. *Phalacrocoracidæ*	
		56. *Plotidæ*	
		57. *Tachypetidæ*	
		58. *Phaethontidæ*	
XII. LONGIPENNES	19. Gaviæ	59. *Laridæ*	70. Lestrinæ.
			71. Larinæ.
			72. Sterninæ.
			73. Rhynchopinæ.
	20. Tubinares	60. *Procellariidæ*	74. Diomedeinæ.
			75. Procellarinæ.
XIII. PYGOPODES		61. *Colymbidæ*	
		62. *Podicipedidæ*	
		63. *Alcidæ*	76. Phaleridinæ.
			77. Alcinæ.
13 Orders.	20 Suborders.	63 Families.	77 Subfamilies.

EXPLANATION OF COLORED FRONTISPIECE.

ANATOMY OF PIGEON, ♀, $\frac{5}{6}$ Nat. Size.

The breast-bone and entire front walls of body removed; the viscera drawn to the right.

A, A, skin of neck turned aside. — **a,** opening of bursa fabricii into cloaca. — **B,** brain removed from skull and turned hind part before (p. 176). — **Bp,** brachial plexus (p. 177). — **b,** opening of oviduct into cloaca (p. 219). — **C,** crop, with left **C′,** and right **C″,** lateral dilatations (p. 212). — **c,** opening of left ureter into cloaca (p. 214). — **ca,** cæca coli, point where small intestines pass into colon (p. 214). — **D, D,** duodenal loop of intestine, enfolding pancreas (p. 213). — **E,** œsophagus, gullet (p. 211). — **Er,** right ear-opening. — **e,** left cerebral hemisphere. — **f,** optic nerve (p. 176). — **G,** gizzard; letter on central tendon (p. 212). — **g** left optic lobe (p. 176). — **H,** heart (p. 196); the unlettered orange-red arteries from it are the short right and long left innominate, latter dividing into left carotid and left subclavian (both cut short), former dividing into right carotid (the long ascending vessel) and right subclavia just over the letters "**Ty**"; main aortic arch (right) not shown (pp. 197, 198); the unlettered bright-blue vessels are the pulmonary arteries. — **Hy,** hyoid arch (p. 167). — **h,** cerebellum (p. 176). — **hd,** hepatic ducts entering duodenum from liver (p. 215). — **i,** termination of rectum in cloaca (p. 214). — **J,** œsophagus between crop and proventriculus. — **Kn,** knee (p. 120). — **k, k, k,** three lobes of kidney, lying in pelvis **p,** ureter **w** passing down upon them to **c** (p. 217). — **L L,** liver, right and left lobes, receiving apex of heart between them (p. 215). — **Lg,** leg (p. 120). — **Lu,** left lung (see p. 200; compare fig. 101). — **M, M′, M″, M‴,** stumps of cut pectoral muscles (p. 193). — **m,** entrance into lung of left bronchial tube. **N, N,** skinned neck. — **n,** spigelian lobe of liver. — **O,** left ovary, inactive (p. 220, fig. 108) **od,** left oviduct, passing down with ureter to **b**. — **P,** pelvis partly exposed (p. 147). — **Pc,** pancreas, lying in duodenal fold of intestine (p. 215). — **Pr,** proventriculus or true stomach, between œsophagus and gizzard (p. 212). — **p,** medulla oblongata, connecting brain with spinal cord (p. 175). — **Q,** coils of intestine, coming down from **D′,** behind **G,** passing **ca** to **i** (p. 213). — **R,** cut ends of several ribs. — **r, r′,** two openings leading from lung to not shown air-sacs (p. 200, fig. 101, *u, u*). — **S,** spleen. — **Sr** is placed over the syrinx; the fleshy bands on each side of the letters are the intrinsic syringeal muscles; the narrower bands diverging from trachea between **Sr** and **Tr** are extrinsic muscles (p. 204, fig. 101, 16, *a–e*). — **Th,** thigh (p. 120). — **Tr,** trachea or wind-pipe (p. 201). — **Ty,** a gland. — **t,** intermediate muscle of the gizzard. — **U** or **V,** remains of skull broken open to remove brain. — **v, v′, v″,** three pancreatic ducts entering intestine (p. 215). — **w,** ureter, see **k,** above. — *Drawn and colored from nature by* Dr. R. W. Shufeldt, U. S. A.

PART III.

SYSTEMATIC SYNOPSIS

OF

NORTH AMERICAN BIRDS.

CLASS AVES: BIRDS.

THIS CLASS OF ANIMALS, while sharply distinguished from Mammals, is so closely related to Reptiles, that the presence of feathers in the former, and their absence from the latter, is the most obvious if not the only positive character by which the two classes are separable.

Though the species of birds are numerous (some 10,000 are known), the structural diversity of the Class is comparatively so slight, that the characters upon which the primary divisions are based seem insignificant in view of those upon which the major groups of Mammals or Reptiles may be founded. With strict regard for equivalency of taxonomic groups, based on morphological considerations, the conventional "class" of Birds is scarcely or not of higher value than an order of Reptiles, with which Birds are associated under the name SAUROPSIDA. But it is not proven that a given structural character may not have classificatory value in one case, different from that which may properly be attributed to it in another; so that, though the most diverse birds may be more alike than are extremes among Lizards for example, we may still continue to speak of a *class Aves*, to be primarily divided into sub-classes or orders.

All known Birds, living and extinct, are divisible into the following primary groups, which may be termed sub-classes:

I. SAURURÆ. — Birds with teeth. Vertebræ biconcave (amphicœlous). Sternum keeled. Wings small, with separate metacarpals. Tail longer than body, its vertebræ not pygostyled, its feathers arranged in distichous series. (One species, *Archæopteryx lithographica*, from the Jurassic of Europe. Fig. 14.)

II. ODONTOTORMÆ. — Birds with teeth, implanted in sockets. Vertebræ biconcave. Wings large, with anchylosed metacarpals. Sternum keeled. Tail short. (Typified by the genus *Ichthyornis*, from the Cretaceous of North America. Fig. 16.)

III. Odontolcæ. — Birds with teeth, implanted in grooves. Vertebræ saddle-shaped (heterocœlous). Wings rudimentary, wanting metacarpals. Sternum without keel. Tail short. (Typified by the genus *Hesperornis*, from the Cretaceous of North America. Fig. 15.)

IV. Ratitæ. — Birds without teeth. Vertebræ (some) saddle-shaped. Wings rudimentary, or at most unfit for flight, with anchylosed metacarpals. Sternum without keel (as in *Odontolcæ*, fig. 15). Tail short. (Embracing the extinct Moas, and the living Ostriches, Cassowaries, Emeus, and Kiwis.)

V. Carinatæ. — Birds without teeth. Vertebræ (some) saddle-shaped. Wings developed, with rare exceptions fit for flight, with anchylosed metacarpals. Sternum keeled. Tail short (as to its vertebræ, which are pygostyled). (Embracing all living birds excepting the *Ratitæ*.)

V. *AVES CARINATÆ: ORDINARY BIRDS.*

The essential characters of this group, which includes all living birds excepting the ostriches and their allies (*ratite* or *struthious* birds), are the absence of teeth, the saddle-shaped faces of the best-developed vertebræ, and the keeled breast-bone (fig. 56), in combination with the perfection of wing-structure in adaptation to aerial (or aquatic) flight. The metacarpals and three metatarsals are anchylosed (figs. 27, 34): the scapula and coracoid meet at less than a right angle (very rarely more), and the furculum is usually perfect (fig. 59). (In the flightless parrot of New Zealand (*Stringops habroptilus*), the sternal keel is rudimentary.) The caudal vertebræ are few, and the last few (pygostyle, fig. 56) are peculiarly modified to support the tail-feathers in fan-like array. There is normally extensive post-acetabular anchylosis of the pelvic bones, which are normally separate there in the other groups (compare figs. 56 and 15).

The division of Carinate birds has always exercised the judgment and ingenuity of ornithologists; no system that has been proposed has been universally adopted, and few if any of the major groups can be considered established and perfectly defined. The orders of *Carinatæ*, therefore, are still provisional. But a great assemblage of birds have been ascertained to agree (with few exceptions) in possessing certain characters, upon the combination of which may be based an

I. — Order PASSERES: Insessores, or Perchers Proper.

The feet are perfectly adapted for grasping by the length and low insertion of the hind toe, great power of apposing which to the front toes, and great mobility of which, are secured by separation of its principal muscle (flexor longus hallucis) from that which bends the other toes collectively (flexor profundus digitorum). The hind toe is always present, perfectly incumbent, and never turned forwards or even sideways: its claw is as long as, or longer than, the claw of the middle toe. The feet are never zygodactyle, nor syndactyle, nor semipalmate, nor palmate; the front toes are usually immovably joined to each other at base, for a part, or the whole, of the basal joints. No one of the front toes is ever versatile. The joints of the toes are always 2, 3, 4, 5, counting from the first (hinder one) to the fourth (outer front one). The toes are always four in number (excepting *Cholornis*). (Figs. 36, 37, 42, 43.) Various as are the shapes of the wings, these members agree in having the great row of coverts not more than half as long as the secondaries; the primaries either nine or ten in number, and the secondaries more than six. (Fig. 30.) The tail, extremely variable in shape, has twelve rectrices (with certain anomalous exceptions). The bill is too variable in form to furnish characters of groups higher than families; but its covering is always hard and horny, in part or wholly, — never extensively membranous, as in many wading and swimming birds, nor softly tumid, as in

pigeons, nor cered, as in parrots and birds of prey. The nostrils do not openly communicate with each other. The oil-gland (p. 86) is nude, and of a characteristic shape. Besides these external characters, which the student may readily examine without dissection, there are some more important anatomical ones. The sternum (with few exceptions) is cast in a particular mould, being manubriated, with prominent costal processes, and having each side of the posterior border single-notched (neither entire, nor deeply nor doubly notched, nor fenestrate; fig. 58). The bony palate has a peculiar structure, called ægithognathous (fig. 79). There is but one carotid artery, the left (fig. 91). The cœca coli are present, though small. There is a peculiarity in the method of insertion of the tensor patagii brevis. Besides possessing the peculiarity of the flexors of the toes, already mentioned, *Passeres* are anomalogonatous (p. 195); that is, the ambiens muscle is absent, as is the accessory femoro-caudal; the femoro-caudal and semitendinosus are present, as is usually also the accessory semitendinosus.

Physiologically, the nature of *Passeres* is altricial and psilopædic (p. 88); that is, the young are hatched weak and naked, and require to be fed for some time in the nest by the parents. They represent the highest grade of physiological development, as well as the most perfect physical organization of the class of birds. Their nervous irritability is great, coördinate with the rapidity of their respiration and circulation; they consume the most oxygen, and live the fastest, of all birds. They habitually reside above the earth, in the air that surrounds it, among the plants that with them adorn it; not on the ground, nor on "the waters under the earth."

Passeres were named by Cuvier in 1798 as an order of birds; the name is simply the plural of the Lat. *passer*, a sparrow. But the group as established by him included many forms which were first properly excluded by the celebrated Nitzsch, who in 1829 limited the group as now accepted. Besides being one of the best defined, it is by far the largest group of its grade in ornithology. For example, of the 888 birds enumerated as North American in the Check List, no fewer than 394 are *Passeres;* as are more than half of all known birds.

Passeres are primarily divisible into two groups, commonly called sub-orders, mainly according to the structure of the vocal organ, — the lower larynx, or syrinx. In one of these groups, the musical apparatus is highly developed, with several distinct pairs of intrinsic muscles, inserted into the ends of the upper three half-rings of the bronchial tubes. In the other, the voice-organ is less complex, with less specialized muscles inserted into the middle portions of the upper bronchial half-rings. The former arrangement is termed *acromyodian*, the latter *mesomyodian*: and the birds which exhibit this difference of structure are respectively called *Passeres acromyodi* and *Passeres mesomyodi*, or *Oscines* and *Clamatores*. (See p. 205, fig. 101.)

Associated with the acromyodian or oscine type of syrinx is a peculiar condition of the tarsal envelope. In nearly all *Oscines*, the tarsus is covered on each side with a horny plate, nearly or quite undivided, meeting its fellow in a sharp ridge behind. This condition of the tarsus is called *bilaminate*, and the birds showing it are *laminiplantar* (figs. 37, 42, 43). In some cases the fusion of the tarsal envelope proceeds so far that the front of the tarsus likewise presents a nearly or quite undivided surface, the whole tarsus being then encased in a "boot," as it is called. A "booted" tarsus may be said to be *trilaminate* (fig. 36). The principal exception to the association of a bilaminate or trilaminate tarsus with an acromyodian syrinx is afforded by the *Alaudidæ*, which have the tarsus scutellate and blunt behind; and, with very few exceptions, no bird which is not acromyodian has a bilaminate tarsus. A third important feature characterizes *Oscines*, as a rule. This is the reduction in length of the first primary, which never equals the longest primary in length, is rarely over two-thirds as long as the longest, is so short as to be called spurious, or is quite rudimentary and apparently wanting, leaving apparently only nine primaries (fig. 30).

Associated with the mesomyodian or clamatorial type of syrinx is seen (with few exceptions) the opposite condition of the tarsus, the sides and back of which, as well as the front, are covered with variously arranged scutella, so that there is no sharp undivided ridge behind.

In such cases there are also ten fully developed primaries, the first of which, if not equalling o, being itself the longest, is at least two-thirds as long. (See p. 428, fig. 279.)

These combinations of characters may be contrasted for the purpose of dividing the great group *Passeres* into two sections, conventionally denominated sub-orders.

1. Suborder PASSERES ACROMYODI, OR OSCINES: Singing Birds.

Syrinx with four or five distinct pairs of intrinsic muscles, inserted at the ends of the three upper bronchial half-rings, representing the acromyodian type of voice-organ, and constituting a highly complex and effective musical apparatus. Side of tarsus covered with a horny plate meeting its fellow in a sharp ridge behind; front of tarsus also sometimes laminate. Primaries ten, with the first short or spurious, or apparently only nine.

Here belong all the North American families of *Passeres*, with the single exception of the *Tyrannidæ*, or Flycatchers, which are clamatorial (mesomyodian). The only North American exceptions to the diagnosis given are afforded by the *Alaudidæ*, or Larks, and certain *Troglodytidæ*, which, with an oscine syrinx and wing-structure, do not have a bilaminate tarsus. Of our 394 Passerine species, no fewer than 363 are Oscine. The name is the Lat. *os'cen*, in n. pl. *os'cines*, divining-birds — those whose notes were regarded as augural.

It is a question, which one of the numerous Oscine families should be placed at the head of the series. Largely, perhaps, through the influence of those ornithologists who hold that fusion of the tarsal envelope into one continuous plate indicates the acme of bird-structure, the place of honor has of late been usually assigned to the thrushes. But only a part of the thrushes themselves show this character; on which account, probably, the rest were associated by Cabanis with the wrens. It seems to me most probable that this character, though unquestionably of high import, should be taken as of less value than the reduction of the number of primaries from ten to nine; and I am at present inclined to believe that eventually some Oscine family with only nine primaries — as the finches or tanagers — will take the leading position. Here, however, I follow usage in the sequence of the North American families of *Oscines*, as follows: — *Turdidæ*, *Chamæidæ*, *Paridæ*, *Sittidæ*, *Certhiidæ*, *Troglodytidæ*, *Alaudidæ*, *Motacillidæ*, *Sylvicolidæ*, *Tanagridæ*, *Hirundinidæ*, *Ampelidæ*, *Vireonidæ*, *Laniidæ*, *Fringillidæ*, *Icteridæ*, *Corvidæ*, *Sturnidæ*.

1. Family TURDIDÆ: Thrushes, etc.

Fig. 113. — Thrushes: European Redwing (*Turdus iliacus*) and Fieldfare (*T. pilaris*). From Dixon.

The essential character of this great group of *Oscines* is, booted tarsi and ten primaries, the 1st spurious. But such expression requires qualification, for the *Turdidæ* do not show this combination without exception, and birds of some other families do possess it. Though it be as natural as any other Oscine family of equal extent and variety, and equally close relationships with other groups, it is in the nature of the case insusceptible of perfect definition in concise terms. The North American representatives, however, may readily be circumscribed in a manner enabling the student to assure himself of the family to which they belong. Besides the true Thrushes, the family as at present constituted includes the Mocking Thrushes, Dippers, Blue-birds, Kinglets and Gnat-catchers, with stray representatives of certain Old World forms. the Chats and Sylvines, sometimes held to represent separate families (*Saxico-*

lidæ and *Sylviidæ*), between which and *Turdidæ*, however, no line whatever can be drawn. The vast assemblage of Old World Warblers are in fact much more thoroughly Thrush-like than are our *Miminæ*, for example; and the *Turdidæ* would be much more homogeneous and easy to characterize if the Mock-birds and Gnat-catchers, with scutellate tarsi and not strict[1]-spurious 1st primary, were to be excluded. The relationships of the *Miminæ* with the Wrer are really so close, that they have often been associated with the *Troglodytidæ*, to which they would probably be best assigned after all. The position of *Polioptila* is uncertain; but it cannot well go with *Paridæ*, and does not seem to be very different from some of the Sylvine forms now brought under *Turdidæ*.

The North American members of the *Turdidæ* offer collectively the following characters: —

Wing of ten primaries, of which the 1st is spurious or quite short — attaining functional size only in *Miminæ* and *Polioptilinæ*. Wing more or less elongate and pointed, longer than the tail (shorter and more rounded in *Polioptila* and most *Miminæ*). Inner secondaries never long and flowing as in *Motacillidæ*. Bill never stout and conical, nor with angulated commissure, nor flattened with gape reaching under the eyes; usually slender, straight or little curved, more or less compressed, subulate and acute, usually notched at end of upper mandible (but the nick frequently obsolete, and whole bill attaining extraordinary characters in *Harporhynchus*). Nostrils oval or roundish, rarely linear, exposed in conspicuous nasal fossæ; nearly or quite reached or overreached by the frontal feathers, but never concealed by a dense ruff as in *Paridæ* and *Sittidæ*. Rictus bristled or with bristle-tipped feathers, except in *Cinclus*. Tarsus normally booted, the anterior scutella, excepting a few below, being fused in a continuous plate, — not so in *Miminæ* and *Polioptilinæ*. On the sides and behind, tarsus strictly laminiplantar (compare *Alaudidæ* and some *Troglodytidæ*). Tarsus usually also long and slender; never decidedly shorter than the middle toe and claw, often decidedly longer. Anterior toes deeply cleft, the inner to its very base, the outer adherent to the middle for only the length of its basal joint (compare *Troglodytidæ*). Hind claw never lengthened and straightened as usual in *Motacillidæ*. Tail feathers twelve; tail normally much shorter than the wings, sometimes about equal, only decidedly longer in some *Miminæ*; never cuneate, nor deeply forked, nor doubly rounded.

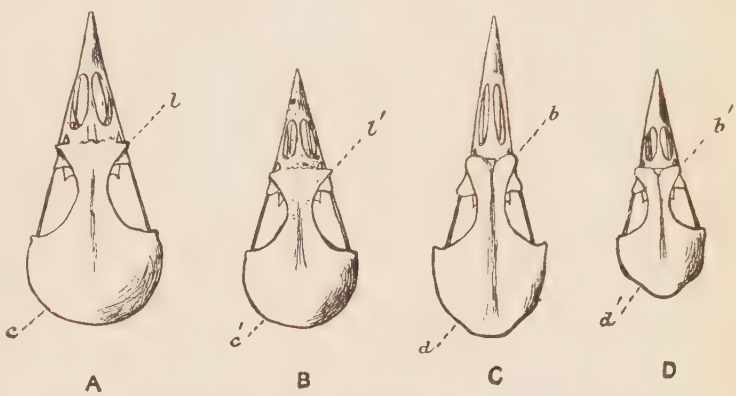

FIG. 114. — Skulls of *Turdidæ* and *Sylvicolidæ*, nat. size; after Shufeldt. A, *Oroscoptes montanus*; B, *Sialia mexicana*; C, *Cinclus mexicanus*; D, *Siurus nævius*. Observe likeness between A and B, at points marked *c*, *c'*, *l*, *l'*; and between C and D, at points marked *b*, *b'*, *d*, *d'*.

Any North American bird showing booted tarsi, ten primaries, the 1st spurious, — and not double-rounded tail — is one of the *Turdidæ*. The group thus constituted is divisible into several sub-families, which may be analyzed as follows with reference to the North American genera: —

ANALYSIS OF SUBFAMILIES.

TURDINÆ: *Typical Thrushes.* Tarsi booted. Rictus bristly. Nostrils oval, exposed. Bill straight, shorter than head. First quill strictly spurious; 2d between 4th and 6th. Tail

shorter than wings. Tarsus little if any longer than the middle toe and claw. Of medium size. Cosmopolitan. One genus — *Turdus*.

MIMINÆ: *Mocking Thrushes.* Tarsal scutella usually distinct. Bill variable, sometimes attaining extraordinary length and curvature. Rictus bristly. Nostrils oval, exposed. Wings short and rounded; 1st quill not strictly spurious, at least one-half as long as 2d, which is shorter than 6th. Tail equalling or much longer than wings. Of medium and largest size. Peculiar to America. An aberrant group, related to the *Troglodytidæ*. Three genera, — *Oroscoptes* (fig. 114, *A*), *Mimus*, *Harporhynchus*.

CINCLINÆ: *Dippers.* Tarsi booted. Bill shorter than head. Nostrils linear, exposed, but overreached by feathers. No bristles whatever about rictus. Wings short, but still longer than the very short square tail, with strictly spurious 1st primary. Form stout. Plumage dense. Habits aquatic. Cosmopolitan. One genus — *Cinclus* (fig. 114, *C*).

SAXICOLINÆ: *Chats*, etc. Tarsi booted. Bill small, much shorter than head. Rictus bristly. Nostrils oval. Wings pointed, exceeding the short, square or emarginate tail. Tarsus usually much longer than the middle toe and claw (not in *Sialia*). Of small size and slender form, and for the most part terrestrial; but scarcely distinguished from *Turdinæ* proper. Chiefly Old World. Three genera, — *Saxicola*, *Cyanecula*, and *Sialia* (fig. 114, *B*).

REGULINÆ: *Kinglets.* Tarsi booted (scutella rarely appreciable). Bill much as in *Turdinæ*, but small and weak. Nostrils exposed, or overhung by tiny feathers. Wings pointed, with strictly spurious 1st primary, longer than the even or emarginate tail. Tarsi longer than middle toe and claw. Very small; under six inches. Greenish, often with flaming crest. Chiefly Old World. Two genera, — *Phylloscopus* and *Regulus*.

POLIOPTILINÆ: *Gnat-catchers.* Tarsi scutellate. Bill very slender, but widened and flattened at base, with acute notched and hooked tip. Rictus strongly bristled. Nostrils entirely exposed. First primary not strictly spurious, half as long as the 2d. Very small; under six inches. Coloration bluish, black and white. Peculiar to America. One genus — *Polioptila*.

Artificial Key to the Genera.

Tarsi distinctly scutellate (if not, crissum reddish). Wings not longer than tail.
- Length under 6 inches. Colors bluish, black and white . . . . . *Polioptila* 11
- Length over 6 inches.
  - Bill about as long as head or much longer. Tail decidedly longer than wings. *Harporhynchus* 4
  - Bill shorter than head.
    - Wings and tail of about equal lengths. Ashy, spotted below . . . . . *Oroscoptes* 2
    - Wings rather shorter than tail. Ashy, adults plain below; or cap black . . . . *Mimus* 3

Tarsi booted (anterior scutella at most indistinct).
- Length 5 inches or less. Colors greenish and yellowish.
  - A flame-colored crest . . . . . *Regulus* 10
  - No colored crest . . . . . *Phylloscopus* 9
- Length over 5 inches.
  - No bristles about bill. Whole-colored. Aquatic . . . . . *Cinclus* 7
  - Rictus bristled.
    - Tarsus much longer than middle toe and claw.
      - Blue on throat, reddish on tail . . . . . *Cyanecula* 8
      - No blue or reddish. Tail black and white . . . . . *Saxicola* 5
    - Tarsus little if any longer than middle toe and claw.
      - Coloration chiefly blue; bill and feet black . . . . . *Sialia* 6
      - No blue. Bill and feet not black . . . . . *Turdus* 1

OBS. — In determining character of tarsus, whether booted or scutellate, it is necessary to examine adult birds; for the fusion of the anterior scutella is progressive, and only accomplished perfectly at maturity. And in general, in using artificial keys to genera and species, the student must agree with the author in understanding that specimens fairly illustrating normal adult characters are in hand.

I. Subfamily TURDINÆ: Typical Thrushes.

FIG. 115. — A typical Thrush, the European Blackbird (*Turdus merula*). From Dixon.

With the tarsus, in the adult, "booted" or enveloped in a continuous plate, formed by fusion of all the tarsal scutella excepting two or three just above the base of the toes (fig. 36). Toes deeply cleft, — the inner to the very base, the outer coherent with the middle only for the length of its basal joint. Wings more or less pointed, longer than the tail; 1st primary spurious, and very short; 2d longer than 6th. Bill moderate, shorter than the head, straight, more or less subulate, little depressed at base, with bristly rictus. Nostrils oval, nearly or quite reached by the frontal feathers. (Fig. 116.) Tail-feathers widening somewhat toward their ends; tail as a whole somewhat fan-shaped; neither decidedly forked at the end, nor much graduated. Upwards of one hundred and fifty species are now usually assigned to the *Turdinæ*, most of them referable to the single genus *Turdus* and its subdivisions. They are nearly cosmopolitan, and have a great development in the warmer parts of America, where they are mainly represented by types closely allied to *Turdus* proper; more aberrant forms, constituting very distinct genera, occur in the Old World. We have but one genus in North America, of which the robin is the most familiar, as it is a very characteristic, example; a species of *Catharus*, however, occurs very near if not actually over our Mexican border. The thrushes are diffused over all the woodland parts of our country, and are all strictly migratory insectivorous birds, though feeding also upon berries and other soft fruits. Though not truly gregarious, some, as the robin for instance, often collect in troops at favorite feeding places, or migrate in companies. They build rather rude nests, often plastered with mud, never pensile, but saddled on a bough or fixed on a fork, or set on the ground; and lay from four to six green or blue eggs, sometimes plain, sometimes spotted. All are vocal; and some, like the wood thrush, are exquisitely melodious.

These birds may be taken in illustration of a character which runs through other of the groups of *Turdidæ* besides the *Turdinæ* proper. The young, in their first feathering, which is worn but a short time, are curiously speckled and streaked, in a manner quite different from the adults. This feature is well shown by a young robin, or blue-bird, as described beyond.

1. **TURDUS.** (Lat. *turdus*, a thrush.) THRUSHES. The characters of the typical and single genus represented in North America are in effect the same as those of the subfamily already given. The several species fall in three subgenera, which may be thus analyzed: —

Merula. — Sexes similar. Bill notched near end, little widened at base. Tarsi little longer than middle toe and claw. Beneath mostly unicolor, with streaked throat. Large; stout. (Type, *Turdus merula;* includes our robins.)

Hesperocichla. — Sexes dissimilar. Bill unnotched. Male with a black pectoral collar. Otherwise like *Merula.* (Type, and only species, *Turdus naevius.*)

Turdus. — Sexes similar. Bill notched near end, much widened and depressed at base. Tarsi decidedly longer than middle toe and claw. Beneath spotted. Of small stature, and rather slender form.

Analysis of Species and Varieties.

Neither spotted nor banded below, but throat streaked. (Robins.)
- Upper parts slate-colored; breast chestnut.
  - Outer tail-feather with white tipping. (Eastern) . . . . . *migratorius* 1
  - Outer tail-feather without decided white tipping. (Western.) . . . . . *propinquus* 2
- Upper parts grayish-ash; breast yellowish-buff. (Cape St. Lucas.) . . . . . *confinis* 3

Streaked below on white ground, with reddish sides. (European.) . . . . . *iliacus* 4
Banded crosswise, not spotted, below; upper parts slate-colored. (Western.) . . . . . *nævius* 5
Spotted below on white or tawny ground, or on both.
Upper parts not of uniform color.
Upper parts tawny, shading to olive on rump. (Wood Thrush, eastern.) . . . . . *mustelinus* 6
Upper parts olive, shading to rufous on rump.
Of medium size. (Hermit Thrush, eastern.) . . . . . *nanus* 10
Of largest size. (Hermit Thrush, Rocky Mts.) . . . . . *auduboni* 9
Of smallest size. (Hermit Thrush, Pacific coast.) . . . . . *unalascæ* 8
Upper parts of uniform color throughout.
Upper parts tawny: spots below few, pale, chiefly confined to buff jugulum: no buff eye-ring. (Tawny Thrush, eastern.) . . . . . *fuscescens* 7
Upper parts russet olive; under parts as before; no buff eye-ring. (Tawny Thrush, western.) . . . . . *salicicola* 7
Upper parts russet olive; spots below numerous, invading white breast; a buff eye-ring. (Western Olive-backed Thrush.) . . . . . *ustulatus* 11
Upper parts dark pure olive; spots below as before; a buff eye-ring. (Eastern Olive-backed Thrush.) . . . . . *swainsoni* 13
Upper parts dark pure olive; spots below as before; no buff eye-ring. (Eastern.) . . . *aliciæ* 12

1. T. migrato′rius. (Lat. *migratorius*, migratory; *migrator*, a wanderer. Figs. 36, 58, 116.) Robin. ♂, in summer: Upper parts slate-color, with a shade of olive. Head black, the eyelids and a spot before the eye white, and the throat streaked with white. Quills of the wings dusky, edged with hoary ash, and with the color of the back. Tail blackish, the outer feather usually tipped with white. Under parts, to the vent, including the under wing-coverts, chestnut. Under tail-coverts and tibiæ white, showing more or less plumbeous. Bill yellow, often with a dusky tip. Mouth yellow. Eyes dark brown. Feet blackish, the soles yellowish. Length about 10.00; extent 16.00; wing 5.00–5.50; tail 4.00–4.50; bill 0.80; tarsus, or middle toe and claw, 1.25. ♀, in summer: Similar, but the colors duller; upper parts rather olivaceous-gray; chestnut of the under parts paler, the feathers skirted with gray or white; head and tail less blackish; throat with more white. Bill much clouded with dusky. ♂ ♀, in winter, and young: Similar to the adult ♀, but receding somewhat farther from the ♂ in summer by the duller colors, the paleness and restriction of the chestnut, with its extensive skirting with white, lack of distinction of the color of the head from that of the back, tendency of the white spot before the eye to run into a superciliary streak, and dark color of most of the bill. Very young birds have the back speckled, each feather being whitish centrally, with a dusky tip; and the cinnamon of the under parts is spotted with blackish. The greater coverts are tipped with white or rufous, frequently persistent, as are also some similar markings on the lesser coverts. N. Am. at large; an abundant and familiar bird, migratory, but breeding anywhere in its range. Nest in trees, usually saddled on a horizontal bough, composed largely of mud; eggs 4–6, about 1.18 × 0.80, uniform greenish-blue, normally unspotted.

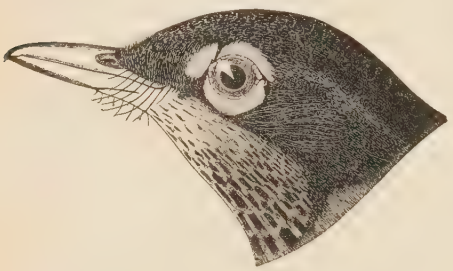

Fig. 116. — Robin, nat. size. (Ad. nat. del. E. C.)

2. T. m. propin′quus? (Lat. *propinquus*, neighboring; as related to the last.) Allied Robin. Quite like *T. migratorius*; averaging slightly larger; wing up to 5.60; tail up to 4.70, not so blackish as that of *T. migratorius*, the outer feather without white, or merely a narrow edging. A scarcely distinguished race, of the Rocky Mt. region and westward.

3. T. confi′nis. (Lat. *confinis*, allied or related; as to *T. migratorius*.) St. Lucas Robin. Upper parts, including sides of head and neck, uniform grayish-ash, with slight olive shade, scarcely darker on the head; chin and throat white, streaked with ashy-brown; breast, sides,

and lining of wings pale yellowish-buff, belly white, flanks ashy. A distinct white superciliary stripe; lower eyelid white. Feathers of jugulum and sides with ashy tips; greater wing-coverts tipped with whitish; bill yellowish, upper mandible and tip of lower tinged with dusky; feet pale brown. Wing 5.10; tail 4.10; tarsus 1.20; middle toe and claw 1.07. Lower California; resembling a young robin, but quite distinct.

4. **T. ili'acus.** (Lat. *iliacus*, relating to the flanks, which are red. Fig. 113.) RED-WINGED THRUSH. Upper parts hair-brown with an olive shade, darker on the head, paler on the rump. Wing-quills deep brown; coverts and inner secondaries tipped with whitish. Tail dark brown, the outer feather usually white-tipped. Lore blackish; eyelids and superciliary stripe whitish; auriculars streaked with light and dark brown. Throat yellowish-white, streaked with brownish-black; breast and belly grayish-white; lower tail-coverts whitish, streaked with brown. Sides and under wing-coverts light red. Bill brownish-black, basal half of lower mandible orange-yellow; iris brown; feet flesh-colored. Sexes alike. Length 8.50; extent 14.00; wing 4.50; tail 3.50; bill 0.75; tarsus, or middle toe and claw, 1.15. A European species, only N. American as occurring in Greenland. The upper parts are almost exactly like a robin's; the lower whitish, streaked with dusky, the sides of the body and lining of the wings bright chestnut.

5. **T. næ'vius.** (Lat. *nævius*, spotted, varied; *nævus*, a birth-mark. Fig. 117.) VARIED THRUSH. OREGON ROBIN. ♂, in summer: Entire upper parts dark slate-color, varying in shade from a blackish to a plumbeous slate, in less perfect specimens with a slight olive tinge; wings and tail blackish, with more or less of plumbeous or olive shade, according to the age of the quills; wing-coverts, greater and lesser, tipped with orange-brown forming two cross-bars, and quills edged in two or three places with the same; quills also white at base on the inner webs, this marking not visible from the outside; one or several of the lateral tail-feathers tipped with white. A broad black collar across the breast, mounting on the side of the neck and head. Stripe behind the eye, lower eyelid, and under parts orange-brown, gradually giving way to white on the lower belly; vent and crissum mixed white, orange-brown, and plumbeous. Bill black; feet and claws dull yellowish. Length 9.50-10.00; extent about 16.00; wing 5.00; tail 3.75; bill 0.80; tarsus, or middle toe and claw, 1.25. ♀, in summer: Upper parts olivaceous-plumbeous (almost exactly the shade of the common robin in winter); wings and tail scarcely darker; the pectoral collar narrow, like the back in color; other under parts like those of the ♂, but duller, paler, and rather rusty than orange-brown, with more white on the lower belly. Markings of head, tail, and wings exactly as in the male. Young: Like the adult ♀. Upper parts in many cases with a decided umber-brown wash. No speckled stage, like that of the very young robin, has been observed, though August specimens have been examined. In the young ♂, the black pectoral bar is at first indicated by interrupted blackish crescents on individual feathers. Young ♀♀ sometimes show scarcely a trace of the collar. At all ages, the markings of the head and wings are much the same. Pacific coast region, Alaska

FIG. 117. — Varied Thrush (*Turdus nævius*), nat. size. (Ad. nat. del. E. C.)

to Mexico, abundant, migratory; accidental in Mass., N. J., and Long Island. A beautiful and very distinct species, representing the subgenus *Hesperocichla* (Gr. ἕσπερος, *hesperos*, Lat. *vesperus*, western, and κίχλα. *kichla*, a thrush). Nest in bushes, of twigs, grasses, mosses, and lichens; eggs 1.12 × 0.80, light greenish-blue, speckled with dark brown.

6. **T. musteli'nus.** (Lat. *mustelinus*, weasel-like; i. e., tawny in color; *mustela*, a weasel. Fig. 118.) Wood Thrush. ♂ ♀, adult: Upper parts, including the surface of the closed wings, tawny-brown, purest and deepest on the head, shading insensibly into olivaceous on the rump and tail. Below, pure white, faintly tinged on the breast with buff, and everywhere, except on the throat, middle of belly, and crissum, marked with numerous large, well-defined, rounded or subtriangular blackish spots. Inner webs and ends of quills fuscous, with a white or buffy edging toward the base. Greater under wing-coverts mostly white. Auriculars sharply streaked with dusky and white. Bill blackish-brown, with flesh-colored or yellowish base. Feet like this part of the bill. Length 7.50-8.00; extent about 13.00; wing 4.00-4.25; tail 3.00-3.25; bill 0.75; tarsus 1.25; middle toe and claw less. Young: Speckled or streaked above with pale yellowish or whitish, especially noticeable as triangular spots on the wing-coverts. But these speedily disappear, when a plumage scarcely different from that of the adult is assumed. The most strongly marked species of the subgenus. In *T. unalascæ*, the only other one showing both tawny and olive on the upper parts, the position of the two colors is reversed, the tawny occupying the rump, the olive the head. In no other species are the spots below so large, sharp, numerous, and generally dispersed. Eastern U. S., N. to New England only; a famous vocalist, common in low damp woods and thickets; migratory; breeds throughout its range; nest in bushes and low trees, of leaves, grasses, etc., and mud; eggs usually 4-5, plain greenish-blue like those of the robin, but smaller: 1.08 × 0.70.

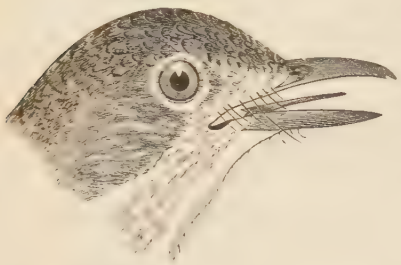

Fig. 118. — Wood Thrush (*T. mustelinus*), nat. size. (Ad. nat. del. E. C.)

7. **T. fusces'cens.** (Lat. *fuscescens*, less than *fuscus*, dark.) Wilson's Thrush. Veery. ♂ ♀ : Upper parts reddish-brown, with slight olive shade; no contrast of color between back and tail; quills and tail-feathers darker and purer brown, the former with white or buff spaces at the concealed bases of the inner webs (as usual in this subgenus). *No* orbital light ring around the eye; auriculars only obsoletely streaky. Below, white; the sides shaded with hoary-gray or pale grayish-olive; the jugulum buff-colored, contrasting strongly with the white of the breast, and marked with a few small brown arrow-heads, the chin and middle line of throat, however, nearly white and immaculate. A *few* obsolete grayish-olive spots in the white of the breast; but otherwise the markings confined to the buff area. Bill dark above, mostly pale below, like the feet. ♂, Length 7.25–7.50; extent about 12.00; wing 4.00–4.25; tail 3.00–3.25; bill 0.60; tarsus 1.20. ♀, smaller; average of both sexes: length 7.35; extent 11.75; wing 3.90; tail 2.85; tarsus 1.12. Chiefly eastern U. S., but N. to Canada; common, migratory, nesting in northerly parts of its range. Nest on ground or near it, of leaves, grasses, etc., but no mud; eggs 4–5, greenish-blue like those of the wood thrush, normally unspotted, 0.90 × 0.60. A delightful songster, like others of the genus, found in thick woods and swamps; of shy and retiring habits.

7a. **T. f. salici'cola.** (Lat. *salix*, a willow; *colo*, I cultivate.) Willow Tawny Thrush. Like *T. fuscescens*, but averaging larger, the upper parts less decidedly tawny, the jugulum less distinctly buff. Wing 3.80–4.25, av. 4.02; tail 2.95–3.40, av. 3.20; bill 0.55–0.60; tarsus, av. 1.17; middle toe without claw, av. 0.69. A slight form recently described by Mr. Ridgway, inhabiting the lower willowy portions of the Rocky Mt. region, U. S. This variety is clearly

referable to *T. fuscescens;* but it bears an extraordinary resemblance to *T. ustulatus*, in the russet-olive color of the upper parts, and only slightly buff tinge of the jugulum. It is distinguished from *ustulatus* by lack of the buff orbital ring so characteristic of *ustulatus* and *swainsoni*, and other characters by which *fuscescens* differs, notably the few if any spots in the white breast back of the buff area, and pale hoary gray instead of sordid olive-gray shading of the sides. The nest and eggs are presumably like those of *fuscescens*, not like those of *ustulatus* or *swainsoni*. (Not in Check List, 1882.)

8. T. unalas'cæ. (Named from the island of Unalaska.) WESTERN HERMIT THRUSH. In color absolutely like No. 10; in size slightly less on an average; length scarcely 7.00; wing 3.30: tail 2.50; tarsus 1.15. Pacific coast region of N. A.

9. T. u. au'duboni. (To J. J. Audubon.) AUDUBON'S HERMIT THRUSH. In color absolutely like No. 10; in size larger on an average; length about 7.75; wing 4.20; tail 3.30; tarsus 1.30. Southern Rocky Mt. region. A better marked variety than the last.

10. T. u. na'nus. (Gr. *νάνος*, Lat. *nanus*, a dwarf.) EASTERN HERMIT THRUSH. ♂ ♀, in summer: Upper parts olivaceous, with a brownish cast, and therefore not so pure as in *swainsoni;* this color changing on the rump and upper tail-coverts into the rufous of the tail, in decided contrast with the back. Under parts white, shaded with grayish-olive on the sides; the breast, jugulum, and sides of the neck more or less strongly tinged with yellowish, and marked with numerous large, angular, dusky spots, which extend back of the yellowish-tinted parts. Throat immaculate. A yellowish orbital ring. Bill brownish-black, most of the under mandible livid whitish; mouth yellow, eyes brown; legs pale brownish. ♂, length 7.00–7.25; extent 11.00–12.00; wing 3.50–3.75; tail 2.75–3.00. ♀, smaller; length 6.75–7.00; extent 10.75–11.25; wing 3.25–3.50. Averages of both sexes are: length 7.00; extent 11.25; wing 3.50; tail 2.75; tarsus 1.15. The dimensions thus overlap those of both *unalascæ* and *auduboni*, and no positive discrimination is possible; the differences, when any, being of averages, not of extremes either way. ♂ ♀, in winter: The olivaceous of the upper parts assumes a more rufous cast, much like that of *ustulatus*, and the yellowish wash of the under parts and sides of the head and neck is more strongly pronounced. But the most rufous specimens are readily distinguished from *fuscescens* by the strong contrast between the color of the tail and other upper parts. Very young: Most of the upper parts marked with pale yellowish longitudinal streaks, with clubbed extremities, and dusky specks at the end; while the feathers of the belly and flanks are often skirted with dusky in addition to the numerous blackish spots of the rest of the under parts. N. Am. at large, but chiefly the Eastern Province; abundant; migratory, and found in all woodland, but breeds only northerly, from Massachusetts and corresponding latitudes to the Arctic regions; winters in the Southern States. Nest and eggs not distinguishable from those of the Veery (No. 7).

11. T. ustula'tus. (Lat. *ustulatus*, scorched, singed; referring to the warm russet coloration.) OREGON OLIVE-BACKED THRUSH. RUSSET-BACKED THRUSH. Quite like *T. swainsoni* proper, No. 13, in uniformity of the color of the whole upper parts, presence of a buff orbital ring, and general character of the shading and spotting of the under parts; but olive of the upper parts not pure, having a decided rufous tinge, resulting in a russet-olive of exactly the shade of that of the upper parts of the Western variety of *fuscescens* (*salicicola*); from which it is distinguished by the buff orbital ring, and very different shading and marking of the under parts (compare No. 7 a); there being, as in *swainsoni* proper, much olive-gray spotting of the white breast back of the buff area, and much shading of the same olive-gray on the sides. Size of *swainsoni*. Nest in bushes, and eggs spotted, as in the latter. Pacific coast region of the U. S., abundant.

12. T. u. ali'ciæ. (To Miss Alice Kennicott, sister of Robert Kennicott.) GRAY-CHEEKED THRUSH. Similar to *swainsoni* in uniformity and purity of the olive of the upper parts, which is as dark and pure (no tendency to the rufous of *ustulatus*); but the sides of the head lack-

ing the yellowish or buffy suffusion seen in *swainsoni*, being thus like the back, or merely grayer; *no* buff ring around eye; breast slightly if at all tinged with yellowish. Rather larger than *swainsoni*, about equalling *mustelinus:* length 7.50–8.00; extent 12.50–13.50; wing 4.00–4.25; tail 3.00–3.25; bill over 0.50; average dimensions about the maxima of *swainsoni*. Distribution and nesting the same, but breeding range more northerly(?). A well-marked variety, perhaps a distinct species. (A local race has been described as smaller, with the bill usually slenderer; Catskill and White Mts.; *T. aliciæ bicknelli* Ridgw.)

13. T. u. swain'soni. (To Wm. Swainson, an English naturalist.) OLIVE-BACKED THRUSH. ♂ ♀: Above, clear olivaceous, of exactly the same shade over all the upper parts; below, white, strongly shaded with olive-gray on the sides and flanks, the throat, breast, and sides of the neck and head strongly tinged with yellowish, the fore parts, excepting the throat, marked with numerous large, broad, dusky spots, which extend backward on the breast and belly, there rather paler, and more like the olivaceous of the upper parts. Edges of eyelids yellowish, forming a strong buff orbital ring; lores the same. Mouth yellow; bill blackish, the basal half of lower mandible pale; iris dark brown; feet pale ashy-brown. Length of ♂, 7.00–7.50; extent 12.00–12.50; wing 3.75–4.00; tail 2.75–3.00; bill 0.50; tarsus 1.10. ♀ averaging smaller; length 6.75; extent 11.50–12.00, etc. North America, N. to high latitudes, W. to the Rocky Mts., common; migratory; breeds from New England northward. Nest in bushes and low trees, thus in situation like that of the wood thrush, but no mud in its composition; eggs unlike those of *mustelinus*, *fuscescens*, and the varieties of *unalascæ*, in being freely speckled with different shades of brown on a greenish-blue ground; size 0.90 × 0.66; number 4–5.

2. Subfamily MIMINÆ: Mocking Thrushes.

FIG. 119. — Mocking-bird, about ⅔ nat. size. (After Wilson.)

Aberrant *Turdidæ*, departing from the prime characteristic of the family in having the tarsi scutellate in front (the scutella sometimes fusing, however, as in the catbird), and the 1st primary, though short, hardly to be called spurious. Wings short and rounded (for this family), about equal to the tail only in *Oroscoptes;* 2d primary shorter than the 6th. Tail large and rounded or much graduated, usually decidedly longer than the wings. Tarsus about equal to the middle toe and claw; feet stout, in adaptation to somewhat terrestrial life. Bill various in form, usually longer or at least more curved than in the true thrushes; in *Harporhynchus* attaining extraordinary length and curvature. Birds much like overgrown wrens (with which they have been associated by some); distinguished chiefly by greater size, different nostrils and rictal bristles, and more deeply-cleft toes. As a group they are rather southern, hardly passing beyond the United States; few species reaching even the Middle States, and the maximum development being in Central and South America. They are peculiar to America, where they are represented by *Oroscoptes*, *Mimus*, *Harporhynchus*, and five or six related

genera, with upward of forty recorded species, two-thirds of which are certainly genuine. About one-half of these fall in *Mimus* alone; of *Harporhynchus*, nearly all the species occur in the United States. In their general habits they resemble wrens as much as thrushes, habitually residing in shrubbery near the ground, relying for concealment as much upon the nature of their resorts as upon their own activity and vigilance. They are all melodious, and some, like the immortal mocking-bird, are as famous for their powers of mimicry as for the brilliant execution of their proper songs. In compensation for this great gift of music, perhaps that they may not grow too proud, they are plainly clad, grays and browns being the prevailing colors. The nest is generally built with little art, in a bush, and the eggs, two to six in number, are blue or green, plain or speckled.

Analysis of Genera.

Smallest: bill shortest; wings about equal to tail. Adults speckled below . . . . . *Oroscoptes* 2
Medium: bill moderate; wings a little shorter than tail. Adults plain below . . . . . *Mimus* 3
Largest: bill immoderate; wings much shorter than tail. Plain or spotted below . . . *Harporhynchus* 4

2. **OROSCOP'TES.** (Gr. ὄρος, *oros*, a mountain, and σκώπτης, *scoptes*, a mimic). Mountain Mockers. Wings and tail of equal lengths, the former more pointed than in other genera of *Miminæ*, with the 1st quill not half as long as the 2d, which is between the 6th and 7th; the 3d, 4th, and 5th about equal to one another, and forming the point of the wing. Tail nearly even, its feathers but slightly graduated. Tarsus longer than middle toe and claw, anteriorly distinctly scutellate. Bill much shorter than head, not curved, with obsolete notch near the end. Rictal bristles well developed, the longest reaching beyond the nostrils. *O. montanus* is the only known species.

14. **O. monta'nus.** (Lat. *montanus*, of a mountain.) Mountain Mocking-bird. Sage Thrasher. ♂ ♀, in summer: Above, grayish or brownish-ash, the feathers with obsoletely darker centres. Below, whitish, more or less tinged with pale buffy-brown, everywhere marked with triangular dusky spots, largest and most crowded across the breast, small and sparse, sometimes wanting, on the throat, lower belly, and crissum. Wings fuscous, with much whitish edging on all the quills, and two white bands formed by the tips of the greater and median coverts. Tail like the wings; the outer feather edged and broadly tipped, and all the rest, excepting usually the middle pair, tipped with white in decreasing amount. Bill and feet black or blackish, the former often with pale base. Length about 8.00; wing and tail, each, about 4.00; tarsus 1.12; bill 0.75. Young: Dull brownish above, conspicuously streaked with dusky; the markings below streaky and diffuse. Plains to the Pacific, U. S.; also Texas and Lower California; an interesting species, resembling an undersized young mocking-bird, abundant in the sage-brush of the W. Nest on ground or in low bushes; eggs usually 4, 1.00 × 0.72, light greenish-blue, heavily marked with brown and neutral tint.

3. **MI'MUS.** (Lat. *mimus*, a mimic.) Mocking-birds. Bill much shorter than head, scarcely curved as a whole, but with gently-curved commissure, notched near the end. Rictal vibrissæ well developed. Tail rather longer than wings, rounded, the lateral feathers being considerably graduated. Wings rounded. (Tarsal scutella sometimes obsolete.) Tarsi longer than the middle toe and claw. Of this genus there are two well marked sections (represented by the mocking-bird and cat-bird respectively), which may be distinguished by color: —

Fig. 120. — Catbird, nat. size. (Ad. nat. del. E. C.)

Mimus. — Above ashy-brown, below white; lateral tail-feathers and bases of primaries white. (Tarsal scutella always distinct.)

Galeoscoptes. — Blackish-ash, scarcely paler below; crown and tail black, unvaried; crissum rufous. (Tarsal scutella sometimes obsolete.)

15. M. polyglot'tus. (Lat. *polyglottus*, many-tongued; from Gr. πολύς, *polus*, many, and γλῶττα, *glotta*, tongue. Fig. 119.) MOCKING-BIRD. ♂, adult: Upper parts ashy-gray; lower parts soiled white. Wings blackish-brown, the primaries, with the exception of the first, marked with a large white space at the base, restricted on the outer quills usually to half or less of these feathers, but occupying nearly all of the inner quills. The shorter white spaces show as a conspicuous spot when the wing is closed, the longer inner ones being hidden by the secondaries. The coverts are also tipped and sometimes edged with white; and there may be much edging or tipping, or both, of the quills themselves. Outer tail-feathers white; next two pair white, except on the outer web; next pair usually white toward the end, and the rest sometimes tipped with white. Bill and feet black, the former often pale at the base below; soles dull yellowish. Length about 10.00, but ranging from 9.50 to 11.00; extent about 14.00 (13.00 to 15.00); wing 4.00–4.50; tail 4.50–5.00; bill 0.75; tarsus 1.25. ♀, adult: Similar, but the colors less clear and pure; above rather brownish than grayish-ash, below sometimes quite brownish-white, at least on the breast. Tail and wings with less white than as above described. But the gradation in these features is by imperceptible degrees, so that there is no infallible color-mark of sex. In general, the clearer and purer are the colors, and the more white there is on the wings and tail, the more likely is the bird to be a ♂ and prove a good singer. The ♀ is also smaller than the ♂ on an average, being generally under and rarely over 10 inches in length, with extent of wings usually less than 14.00; the wing little if any over 4.00, the tail about 4.50. Young: Above decidedly brown, and below speckled with dusky. U. S. from Atlantic to Pacific, southerly; rarely N. to New England, and not common N. of 38°, though known to reach 42°; thronging the groves of the South Atlantic and Gulf States. Nest in bushes and low trees, bulky and inartistic, of twigs, grasses, leaves, etc.; eggs 4-6, measuring on an average 1.00 × 0.75, bluish-green, heavily speckled and freckled with several brownish shades. Two or three broods are generally reared each season, which in the South extends from March to August. When taken from the nest, the "prince of musicians" becomes a contented captive, and has been known to live many years in confinement. Naturally an accomplished songster, he proves an apt scholar, susceptible of improvement by education to an astonishing degree; but there is a great difference with individual birds in this respect.

16. M. carolinen'sis. (Of Carolina: *Carolus*, Charles IX., of France.) (Figs. 37, 120.) CAT-BIRD. ♂ ♀: Slate-gray, paler and more grayish-plumbeous below; crown of head, tail, bill, and feet black. Quills of the wing blackish, edged with the body-color. Under tail-coverts rich dark chestnut or mahogany-color. Length 8.50–9.00; extent 11.00 or more; wing 3.50–3.75; tail 4.00; bill 0.66; tarsus 1.00–1.10. Young: Of a more sooty color above, with little or no distinction of a black cap, and comparatively paler below, where the color has a soiled brownish cast. Crissum dull rufous. U. S. and adjoining British Provinces. West to the Rocky Mts., and even Washington Terr., but chiefly Eastern; migratory, but resident in the Southern States, and breeds throughout its range; nest of sticks, leaves, bark, etc., in bushes; eggs 4–6, deep greenish-blue, not spotted. An abundant and familiar inhabitant of our groves and briery tracts, remarkable for its harsh cry, like the mewing of a cat (whence its name), but also possessed, like all its tribe, of eminent vocal ability.

4. HARPORHYN'CHUS. (Gr. ἅρπη, *harpe*, a sickle; ῥύγχος, *rhygchos*, beak; i. e., bow-billed.) THRASHERS. Bill of indeterminate size and shape, ranging from one extreme, in which it is straight and shorter than the head, to the other, in which it exceeds the head in length and is bent like a bow (see figs. 121–125). Feet large and strong, indicating terrestrial habits; tarsus strongly scutellate anteriorly, about equalling or slightly exceeding in length the middle toe with its claw. Wings and tail rounded, the latter decidedly longer than the former. Rictus with well developed bristles. Viewing only the extreme shapes of the bill, as in *H. rufus* and *H. crissalis*, it would not seem consistent with the minute subdivis-

ions which now obtain in ornithology to place all the species in one genus; but the gradation of form is so gentle that it seems impossible to dismember the group without violence. The arcuation of the bill proceeds *pari passu* with its elongation; the shortest bills being the straightest, and conversely. There is also a curious correlation of color with shape of bill; the short-billed species being the most richly colored and heavily spotted, while the bow-billed ones are very plain, sometimes with no spots whatever on the under parts. Our nine forms of the genus are with one exception South-western, focusing in Arizona, where occur four species, two of them not known elsewhere; two others are confined to California; two to the Mexican border, leaving only one generally distributed. They furnish the following

Analysis of Species and Varieties.

Bill not longer than head (0.87-1.12), little or not curved. Breast spotted.
- Bill 1.00, quite straight. Above rich rusty-red; below whitish, heavily spotted and streaked with dark brown. Eastern . . . . . *rufus* 17
- Bill 1.12, slightly curved. Above dark reddish-brown, below whitish, heavily spotted and streaked with blackish. Texas . . . . . *longirostris* 18
- Bill 1.12, curved. Above ashy-gray, below whitish, breast with round spots of the color of the back. Mexican border and Arizona . . . . . *curvirostris* or *palmeri* 19, 20
- Bill 0.87, scarcely curved. Above grayish-brown, below brownish-white, breast alone with arrow-heads of the color of the back. Arizona. . . . . *bendirii* 12
- Bill 1.12, curved. Above ashy-gray, below whitish, with profuse distinct blackish-brown spots. Lower California . . . . . *cinereus* 22

Bill longer than head (1.50), arcuate. Breast not spotted.
- Dark oily olive-brown, below paler, belly and crissum rufescent. Coast of California . . *redivivus* 23
- Pale ash, paler still below, lower belly and crissum brownish-yellow. Arizona . . . . . *lecontii* 24
- Brownish-ash, paler below, crissum chestnut in marked contrast. Arizona, New Mexico, and California . . . . . *crissalis* 25

17. H. ru'fus. (Lat. *rufus*, rufous, reddish. Fig. 121.) THRASHER. BROWN THRUSH. ♂ ♀: Upper parts uniform rich rust-red, with a bronzy lustre. Concealed portions of quills fuscous. Greater and median wing-coverts blackish near the end, then conspicuously tipped with white. Bastard quills like the coverts. Tail like the back, the lateral feathers with paler ends. Under parts white, more or less strongly tinged, especially on the breast, flanks, and crissum, with tawny or pale cinnamon-brown, the breast and sides marked with a profusion of well-defined spots of dark brown, oval in front, becoming more linear posteriorly. Throat immaculate, bordered with a necklace of spots; middle of the belly and under tail-coverts likewise unspotted. Bill quite straight, black, with yellow base of the lower mandible; feet pale; iris yellow or orange. Length about 11 inches; extent 12.50–14.00; wing 3.75–4.25; tail 5.00 or more; bill 1.00; tarsus 1.25. Eastern U. S. chiefly, but N. to adjoining British Provinces and W. to the Rocky Mts.; migratory, but breeds throughout its range, and winters in the Southern States. A delightful songster, abundant in thickets and shrubbery. Nest in bushes (sometimes on ground), bulky and rude, of sticks, leaves, bark, roots, etc.; eggs 4–5, sometimes 6, 1.05 × 0.80, whitish or greenish, profusely speckled with brown.

FIG. 121. — Thrasher, nat. size. (Ad. nat. del. E. C.)

18. H. r. longiros'tris. (Lat. *longus*, long, and *rostris*, from *rostrum*, beak; i. e., long-billed.) TEXAS THRASHER. Similar to *H. rufus;* upper parts dark reddish-brown, instead of rich foxy-red; under parts white, with little if any tawny tinge, the spots large, very numerous,

and blackish instead of brown; ends of the rectrices scarcely or not lighter than the rest of these feathers; bill almost entirely dark-colored. Besides these points of coloration, there is a decided difference in the shape of the bill. In *H. rufus*, the bill is quite straight, and only just about an inch long; the gonys is straight, and makes an angle with the slightly concave lower outline of the mandibular rami. In *H. longirostris*, the bill is rather over an inch long, and somewhat curved; the outline of the gonys is a little concave, making with the ramus one continuous curve from base to tip of the bill. Size of *H. rufus*. Texas and Mexico.

19. H. curviros'tris. (Lat. *curvus*, curved, and *rostris*; bow-billed.) CURVE-BILLED THRASHER. ♂ ♀: Above, uniform ashy-gray (exactly the color of a mocking-bird), the wings and tail darker and purer brown. Below, dull whitish, tinged with ochraceous, especially on the flanks and crissum, and marked with rounded spots of the color of the back, most numerous and blended on the breast. Throat quite white, immaculate, without maxillary stripes; lower belly and crissum mostly free from spots. No decided markings on the side of the head. Ends of greater and median wing-coverts white, forming two decided cross-bars; tail-feathers distinctly tipped with white. Bill black, over an inch long, curved, stout; feet dark brown. Length of ♂ about 11.00; wing 4.25–4.50; tail 4.50–5.00; bill 1.12; tarsus 1.25; middle toe and claw 1.33. ♀ averaging rather smaller. Mexico, reaching the U. S. border of Texas.

FIG. 122. — Bow-billed Thrasher, nat. size; bill a little too thick. (Ad. nat. del. E. C.)

20. H. c. pal'meri. (To Edw. Palmer. Fig. 122.) BOW-BILLED THRASHER. Above, grayish-brown, nearly uniform; wing-coverts and quills with slight whitish edging, the edge of the wing itself white; tail-feathers with slight whitish tips; below, a paler shade of the color of the upper parts, the throat quite whitish, the crissum slightly rufescent, the breast and belly with obscure dark gray spots on the grayish-white ground; no obvious maxillary streaks, but vague speckling on the cheeks; bill black; feet blackish-brown. Length 10.75; bill 1.12; wing 4.25; tail 5.00; tarsus 1.25; middle toe and claw 1.30. ♀ smaller; wing 3.75; tail 4.50; tarsus 1.20; middle toe and claw 1.12; bill barely 1.00. Although the differences from the typical form are not easy to express, they are readily appreciable on comparison of specimens. The upper parts are quite similar; but the under parts, instead of being whitish, with decided spotting of the color of the back, are grayish, tinged with rusty, especially behind, and the spotting is nebulous. The white on the ends of the wing-coverts and tail-feathers is reduced to a minimum or entirely suppressed. The bill is slenderer and apparently more curved. Arizona, common, in desert regions. Nest in cactus, mezquite and other bushes; eggs usually 3, 1.10 × 0.80, pale greenish-blue profusely dotted with reddish-brown.

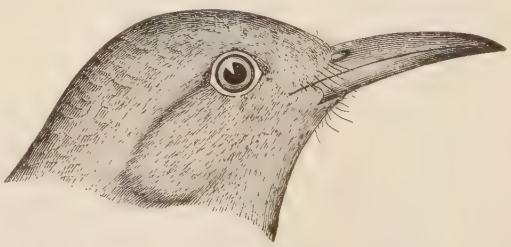

FIG. 123. — Arizona Thrasher, nat. size. (Ad. nat. del. E. C.)

21. H. bendi'rii. (To Capt. Chas. Bendire, U. S. A. Fig. 123.) ARIZONA THRASHER. ♂ ♀: Bill shorter than head, comparatively stout at base, very acute at tip, the culmen quite convex, the gonys just appreciably concave. Tarsus a little longer than the middle toe and claw. 3d and 4th primaries about equal and longest, 5th and 6th successively slightly shorter, 2d equal to 7th, 1st equal to penultimate secondary in the closed wing. Entire upper parts, including upper surfaces of wings

and tail, uniform dull pale grayish-brown, with narrow, faintly-rusty edges of the wing-coverts and inner quills, and equally obscure whitish tipping of the tail-feathers. No maxillary nor auricular streaks; no markings about the head except slight speckling on the cheeks. Under parts brownish-white, palest (nearly white) on the belly and throat, more decidedly rusty-brownish on the sides, flanks, and crissum, the breast alone marked with numerous small arrow-head spots of the color of the back. Bill light-colored at base below. ♂: Length about 9.25; wing 4.00; tail 4.25; bill 0.87; along gape 1.12; tarsus 1.25; middle toe and claw 1.12. ♀ rather smaller; wing, 3.75, etc. Arizona, less common than *palmeri*, with which it is associated. Nest in bushes; eggs 2–3, about 1.00 × 0.73, elliptical rather than oval, whitish, spotted and blotched with reddish-brown.

22. H. ciner'eus. (Lat. *cinereus*, ashy; *cinis, cineris*, ashes. Fig. 124.) ST. LUCAS THRASHER. ♂ ♀: Upper parts uniform ashy-brown; wings and tail similar, but rather purer and darker brown, the former crossed with two white bars formed by the tips of the coverts, the latter tipped with white. Below, dull white, often tinged with rusty, especially behind, and thickly marked with small, sharp, triangular spots of dark brown or blackish. These spots are all perfectly distinct, covering the lower parts excepting the throat, lower belly, and crissum; becoming smaller anteriorly, they run up each side of the throat in a maxillary series bounding the immaculate area. Sides of head finely speckled, and auriculars streaked; bill black, lightening at base below, little longer than that of *H. rufus*, though decidedly curved. Length of ♂ about 10.00; wing 4.00; tail 4.50; bill 1.12; tarsus 1.25; middle toe and claw 1.25. ♀ averaging rather smaller. Young: Upper parts strongly tinged with rusty-brown, this color also edging the wings and tipping the tail. The resemblance of this species to the mountain mocking-bird (*Oroscoptes montanus*) is striking. It is distinguished from any others of the U. S. by the sharpness of the spotting underneath, which equals that of *H. rufus* itself, the small and strictly triangular character of the spots, together with the grayish-brown of the upper parts, and inferior dimensions. Lower California, common. Nest a slight shallow structure of twigs in cactus and other bushes; eggs 1.12 × 0.77, greenish-white, profusely speckled.

FIG. 124. — St. Lucas Thrasher, nat. size. (Ad nat. del. E. C.)

23. H. redivi'vus. (Lat. *redivivus*, revived; the long-lost species having been rediscovered and so named. Fig. 125.) CALIFORNIA THRASHER. ♂: No spots anywhere; wings and tail without decided barring or tipping. Bill as long as the head or longer, bow-shaped, black. Wings very much shorter than the tail. Above, dark oily olive-brown, the wings and tail similar, but rather purer brown. Below, a paler shade of the color of the upper parts, the belly and crissum strongly rusty-brown, the throat definitely whitish in marked contrast, and not bordered by decided maxillary streaks. Cheeks and auriculars blackish-brown, with sharp whitish shaft streaks. Length 11.50; wing 4.00 or rather less; tail 5.00 or more; bill (chord of culmen) nearly or quite 1.50; tarsus 1.35; middle toe and claw about

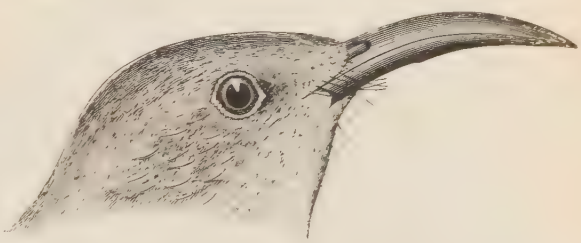

FIG. 125. — California Thrasher, nat. size. (Ad. nat. del. E. C.)

the same. ♀ similar, rather smaller. Coast region of California, abundant in dense chaparral; nest a rude platform of twigs, roots, grasses, leaves, etc., in bushes: eggs 2-3, 1.15 × 0.85, bluish-green, with olive and russet-brown spots.

24. **H. r. lecon'tii.** (To Dr. John L. Le Conte, the entomologist.) YUMA THRASHER. This form, with size and proportions the same as those of *redivivus* proper, differs very notably in the pallor of all the coloration, being in fact a bleached desert race. Excepting the slight maxillary streaks, there are no decided markings anywhere; and the change from the pale ash of the general under parts to the brownish-yellow of the lower belly and crissum is very gradual. Valley of the Gila and Lower Colorado: very rare. Nest in bush, bulky, loose, deep: eggs 2, 1.15×0.77, pale greenish, dotted with reddish.

25. **H. crissa'lis.** (Lat. *crissalis*, relating to the *crissum*, or under tail-coverts. Fig. 126.) CRISSAL THRASHER. ♂: Brownish-ash, with a faint olive shade, the wings and tail purer and darker fuscous, without white edging or tipping. Below, a paler shade of the color of the upper parts. Throat and side of the lower jaw white, with sharp black maxillary streaks. Cheeks and auriculars speckled with whitish. Under tail-coverts rich chestnut,

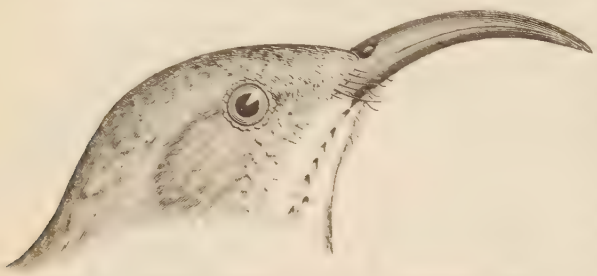

FIG. 126. — Crissal Thrasher, nat. size. (Ad nat. del. E. C.)

in marked contrast with the surrounding parts. Bill black, at the maximum of length, slenderness, and curvature: feet blackish. Length about 12.00; wing 4.00-4.25; tail 5.50-6.00; its lateral feathers 1.50 shorter than the central ones; bill 1.50; tarsus 1.33; middle toe and claw 1.25. This fine species is distinguished by the strongly chestnut under tail-coverts, the contrast being as great as that seen in the cat-bird. The sharp black maxillary streaks are also a strong character. The bill is extremely slender, the tail at a maximum of length, and the feet are notably smaller than those of *H. redivivus*. Arizona, New Mexico, Utah, and California in the Colorado Valley, common in chaparral; nest in bushes near the ground, of twigs lined with vegetable fibres; eggs usually 2, emerald green, unspotted.

3. Subfamily CINCLINÆ: Dippers.

FIG. 127. — European Dipper, *C. aquaticus*. (From Dixon.)

Wing of 10 primaries, the 1st of which is spurious, and, like the others, falcate; 2d primary entering into the point of wing; wing short, stiff, rounded, and concavo-convex. Tail still shorter than the wing, soft, square, of 12 broad, rounded feathers, almost hidden by the coverts, which reach nearly or quite to the end, the under being especially long and full. Tarsi booted, about as long as the middle toe and claw. Lateral toes equal in length. Claws all strongly curved. Bill

shorter than head, slender and compressed throughout, higher than broad at the nostrils, about straight, but seeming to be slightly recurved, owing to a sort of upward tilting of the superior mandible; culmen at first slightly concave, then convex; commissure slightly sinuous, to correspond with the culmen, notched near the end; gonys convex. Nostrils linear, opening beneath a large scale partly covered with feathers. No rictal vibrissæ, nor any trace of bristles or bristle-tipped feathers about the nostrils. Plumage soft, lustreless, remarkably full and compact, water-proof. Body stout, thick-set. Habits aquatic. A small but remarkable group, in which the characters shared by the *Turdinæ*, *Saxicolinæ*, and *Sylviinæ* are modified in adaptation to the singular aquatic life the species lead. There is only one genus, with about 12 species, inhabiting clear mountain streams of most parts of the world, chiefly the Northern Hemisphere; easily *flying under water*, and spending much of their time in that element, where their food, of various aquatic animal substances, is gleaned.

5. **CIN'CLUS.** (Gr. κίγκλος, *kigklos*, Lat. *cinclus*, a kind of bird. Figs. 114, 127, 128.) DIPPERS. Characters those of the subfamily, as above given.

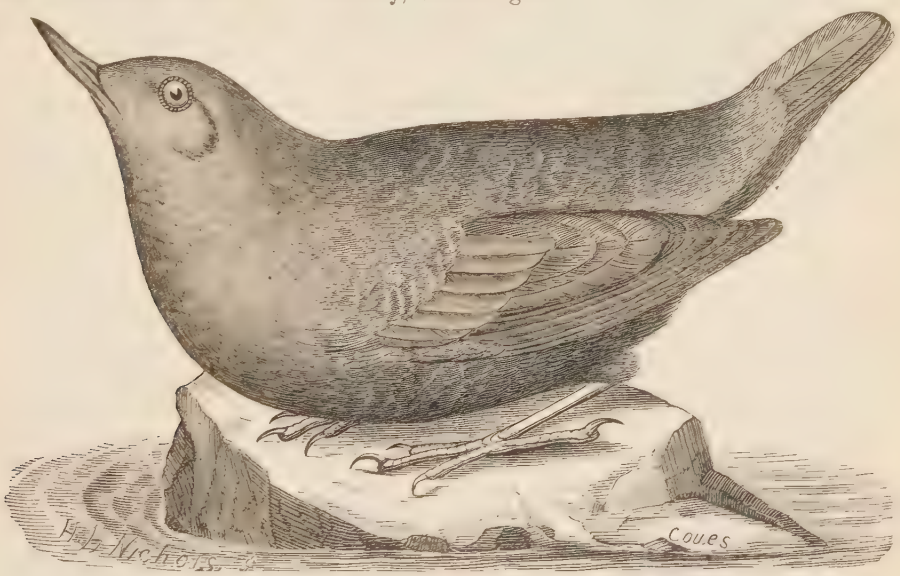

FIG. 128. — American Dipper, nat. size. (Ad nat. del. E. C.)

30. **C. mexica'nus.** (Lat. *mexicanus*, Mexican. Fig. 128.) AMERICAN DIPPER, or WATER OUZEL. ♂ ♀, adult, in summer: Slaty-plumbeous, paler below, inclining on the head to sooty-brown. Quills and tail-feathers fuscous. Eyelids usually white. Bill black; feet yellowish. Length 6.00-7.00; extent 10.00-11.00; wing 3.50-4.00; tail about 2.25; bill 0.60; tarsus 1.12; middle toe and claw rather less. Individuals vary much in size. ♂ ♀, in winter, and most immature specimens, are still paler below, all the feathers of the under parts being skirted with whitish. The quills of the wing are also tipped with white. The bill is yellowish at the base. Young: Below, whitish, more or less so according to age, frequently tinged with pale cinnamon-brown; whole under parts sometimes overlaid with the whitish ends of the feathers, shaded with rufous posteriorly; throat usually nearly white; bill mostly yellow; white tipping of the wing-feathers at a maximum; in some cases the tail-feathers similarly marked. Mountains of Western N. A., from Alaska to Mexico; a sprightly and engaging resident of clear mountain streams, usually observed flitting among the rocks; has a fine song. Nest a pretty ball of green moss lined with grasses, with a hole at the side, hidden in the rift of a rock, or other nook close to the water: eggs about 5, 1.04 × 0.70, pure white, unmarked.

4. Subfamily SAXICOLINÆ: Stone-chats and Blue-birds.

Fig. 129. — Wheat-ear. (From Dixon.)

Chiefly Old World; represented in North America by two European species and the familiar Blue-birds: authors assign different limits to the group, and frequently transpose the genera. As usually constituted, it contains upwards of 100 species, commonly referred to about 12 genera. Like many other groups of *Passeres*, it has never been defined with precision, being known conventionally by the birds ornithologists put in it. The following birds have booted tarsi; oval nostrils; bristled rictus; rather short, square or emarginate tail; long, pointed wings, with very short spurious 1st quill; tarsus not shorter (except in *Sialia* much longer) than middle toe and claw; bill much shorter than head, straight and acute.

Analysis of Genera.

Bill slender. Tarsus much longer than middle toe and claw. Point of wing formed by 2d-4th quills. Lateral toes of equal lengths. Form slender. No blue. Terrestrial . . . . . *Saxicola* 6

Bill very slender. Tarsus much longer than middle toe and claw. Point of wing formed by 3d-5th quills. Lateral toes of unequal lengths. Form slender. Throat intense blue and chestnut; tail with chestnut *Cyanecula* 8

Bill stouter. Tarsus not longer than middle toe and claw. Point of wing formed by 2d-4th quills. Lateral toes of unequal lengths. Blue the chief color. Form stouter. Arboricole . . . . . *Sialia* 7

6. **SAXICOLA.** (Lat. *saxum*, a rock; *colo*, I inhabit. Fig. 130.) Stone-chats. Bill shorter than head, slender, straight, depressed at base, compressed at end, notched. Wings long, pointed, the tip formed by the 2d-4th quills, the 1st spurious, scarcely or not one-fourth as long as the 2d. Tail much shorter than wing, square. Tarsi booted, but with 4 scutella below in front; long and slender, much exceeding the middle toe and claw; lateral toes of about equal lengths, very short, the tips of their claws not reaching the base of the middle claw; claws little curved; feet thus adapted to terrestrial habits. A large and widely distributed Old World genus, of some 30 species, inhabiting Europe, Asia, and especially Africa.

Fig. 130. — Generic details of *Saxicola*.

26. **S. œnan'the.** (Gr. *οἰναν'θη, oinanthe*, name of a bird, from *οἴνη, oine*, the grape, and *ἄνθος, anthos*, a flower. Fig. 129.) Stone-chat. Wheat-ear. Adult ♂: Ashy-gray; forehead, superciliary line and under parts white, latter often brownish-tinted; upper tail-coverts white; wings and tail black, latter with most of the feathers white for half or more of their length; line from nostril to eye, and broad band on side of head, black; bill and feet black. ♀ more brownish-gray, the black cheek-stripe replaced by brown. Young without the stripe, above

olive-brown, superciliary line, edges of wings and tail, and all under parts, cinnamon-brown; tail black and white as in the adult. Length of ♂ 6.75; extent 12.50; wing 3.75; tail 2.50; tarsus 1.00; middle toe and claw 0.75. ♀ smaller: length 6.50; extent 11.50, *etc.* Atlantic coast, from Europe *via* Greenland; also North Pacific and Arctic coast, from Asia. Common in Greenland, and probably also breeds in Labrador. Nest in holes in the ground or rocks, crevices of stone walls, etc.; eggs 4-7, 0.87-0.60, greenish-blue, without spots.

7. SIA'LIA. (Gr. *σιαλίς, sialis*, a kind of bird.) BLUE-BIRDS. Primaries 10, the 1st spurious and very short. Wings pointed, the tip formed by the 2d, 3d, and 4th quills. Tail much shorter than wings, emarginate. Bill about half as long as head or less, straight, stout, wider than deep at base, compressed beyond nostrils, notched near tip, the culmen at first straight, then gently convex to the end, gonys slightly convex and ascending, commissure slightly curved throughout. Nostrils overhung and nearly concealed by projecting bristly feathers; lores and chin likewise bristly. Gape ample, the rictus cleft to below the eyes, furnished with a moderately developed set of bristles reaching about opposite the nostrils. Feet short, though rather stout, adapted exclusively for perching (in *Saxicola* the structure of the feet indicates terrestrial habits). Tarsus not longer than the middle toe; lateral toes of unequal lengths; claws all strongly curved. Blue is the principal color of this beautiful genus, which contains three species. They are strictly arboricole; frequent the skirts of woods, coppices, waysides, and weedy fields; nest in holes, and lay whole-colored eggs; readily become semi-domesticated, like the swallow, house wren, and house sparrow; feed upon insects and berries; and have a melodious warbling song. Polygamy is sometimes practised by them, contrary to the rule among *Oscines*. Blue-birds are peculiar to America, and appear to have no exact representatives in the other hemisphere.

Analysis of Species.

♂ Rich sky-blue, uniform on back; throat and breast chestnut, belly white . . . . . *sialis* 27
♂ Rich sky-blue, including throat: middle of back and breast chestnut, belly whitish . . . . *mexicana* 28
♂ Light blue, paler below, fading to white on belly; no chestnut . . . . . *arctica* 29

27. S. si'alis. (Gr. *σιαλίς, sialis*, a kind of bird. Fig. 131.) EASTERN BLUE-BIRD. WILSON'S BLUE-BIRD. ♂, in full plumage: Rich azure-blue, the ends of the wing-quills blackish; throat, breast, and sides of the body chestnut; belly and crissum white or bluish-white. The blue sometimes extends around the head on the sides and often fore part of the chin, so that the chestnut is cut off from the bill. Length 6.50–7.00; extent 12.00–13.00; wing 3.75–4.00; tail 2.75–3.00; bill 0.45; tarsus 0.70. ♂, in winter, or when not full-plumaged: Blue of the upper parts interrupted by reddish-brown edging of the feathers, or obscured by a general brownish wash. White of belly more extended; tone of the other under parts paler. In many Eastern specimens, the reddish-brown skirting of the feathers blends into a dorsal patch; when this is accompanied by more than ordinary extension of blue on the throat they closely resemble *S. mexicana*. ♀, in full plumage: Blue mixed and obscured with dull reddish-brown; becoming bright and pure on the rump, tail, and wings. Under parts paler and more rusty-brown, with more abdominal white than in the male. Little smaller than ♂. Young, newly fledged: Brown, becoming blue on the wings and tail, the back sharply marked with shaft-lines of whitish. Nearly all the under parts closely and uniformly freckled with white and brownish. A white ring round the eye; inner secondaries edged with brown. From this stage, in which the sexes are indistinguishable, to the perfectly adult condition, the bird changes by insensible degrees.

FIG. 131. — Blue-bird, nat. size. (Ad nat. del. E. C.)

Eastern U. S. and Canada, abundant and familiar, almost domestic; W. often to the Rocky Mts. Migratory, but breeds throughout its range; winters in the Southern States and beyond, whence it comes as one of the early harbingers of spring, or during mild winter weather, bringing its bit of blue sky with cheery, voluble song. Nest in natural or artificial hollows of trees, posts, or bird-boxes, loosely constructed of the most miscellaneous materials; eggs 4–6, pale bluish, occasionally whitish, unmarked, 0.80 × 0.60; two or three broods in one season.

28. **S. mexica'na.** (Lat. *mexicana*, of Mexico.) WESTERN BLUE-BIRD. MEXICAN BLUE-BIRD. ♂, adult: Rich azure-blue, including the head and neck all around. A patch of purplish-chestnut on the middle of the back; breast and sides rich chestnut; belly and vent dull blue or bluish-gray. Bill and feet black. Size of the last species. ♀, and young: Changes of plumage coincident with those of the Eastern blue-bird. Immature birds may usually be recognized by some difference in color between the middle of the back and the other upper parts, and between the color of the throat and of the breast; but birds in the streaky stage could not be determined if the locality were unknown. In some adult males, the dorsal patch is restricted, or broken into two scapular patches with continuous blue between; the chestnut of the breast sometimes divides, permitting connection of the blue of the throat and belly. Specimens with little trace of the dorsal patch are scarcely distinguished from those of *S. sialis* in which there is much blue on the throat,—the grayish-blue of the belly, instead of white, being a principal character. U. S. and Mexico, from Eastern foot-hills of the Rocky Mts. to the Pacific; N. to Vancouver; E. occasionally to the Mississippi. Abundant in the West; habits, nest, and eggs identical with those of *S. sialis*.

29. **S. arc'tica.** (Lat. *arctica*, arctic: *arctos*, a bear; i. e., near the constellation so-named.) ARCTIC BLUE-BIRD. ROCKY MOUNTAIN BLUE-BIRD. ♂, in perfect plumage: Above azure-blue, lighter than in the two foregoing, and with a faint greenish hue; below, paler and more decidedly greenish-blue, fading insensibly into white on the belly and under tail-coverts. Ends of wing-quills dusky; bill and feet black. Larger; length 7.00 or more; extent 13.00 or more; wing 4.50; tail 3.00. ♀: Nearly uniform rufous-gray, lighter and more decidedly rufous below, brightening into blue on rump, tail, and wings, fading into white on belly and crissum; a whitish eye-ring. Young: Changes parallel with those of the other species. Birds in the streaky stage may be known by superior size, and greenish shade on the wings and tail. N. America from the Rocky Mts. to the Pacific, chiefly in high open regions, abundant; resident southerly, migratory further North. Habits those of the others; nesting the same, but eggs larger, about 0.92 × 0.70.

8. **CYANE'CULA.** (A diminutive form of Gr. κυάνεος. Lat. *cyaneus*, blue; as we should say, "bluet.") BLUE-THROATS. Bill much shorter than head, slender, compressed throughout, acute at tip, with obsolete notch (quite as in *Saxicola*, but more compressed and slenderer). Feet, as in *Saxicola*, long and slender; tarsus much longer than the middle toe and claw; lateral toes of unequal lengths, the outer longer, but the tip of its claw still falling short of the base of the middle claw; claws little curved, the hinder fully as long as its digit. Wings long and pointed (less so than in *Saxicola*), the point formed by the 3d, 4th, and 5th quills; 2d about equal to the 6th; 1st spurious, about one-third as long as the longest. Tail of moderate length, slightly rounded. Tail particolored with chestnut; throat and breast with azure-blue and chestnut. The species were formerly included in *Ruticilla*, an Old World genus very closely related to *Saxicola*; they form the connecting link between *Saxicolinæ* proper and *Sylviinæ*, placed by some authors in one, by others in the other group. The relationships with *Saxicola* are certainly very close.

31. **C. sue'cica.** (Lat. *suecica*, Swedish.) BLUE-THROATED REDSTART. RED-SPOTTED BLUE-THROAT. Entire upper parts dark brown with a shade of olive (about the color of a titlark, *Anthus ludovicianus*), the feathers of the crown with darker centres; rump and upper

tail-coverts rather lighter, and mixed with bright chestnut-red. Wings like the back, with slightly paler edgings of the feathers. Middle tail-feathers like back, or rather darker, the rest blackish, with the basal half or more of their length bright chestnut-red, or orange-brown. Lores dusky; a whitish superciliary line. Chin, throat, and forebreast rich ultramarine blue, enclosing a bright chestnut throat-patch; the blue bordered behind by black, this again by chestnut mixed with white. Rest of under parts white, washed on the sides, lining of wings and under tail-coverts with pale fulvous. Bill and feet black. ♀ and young similar, the throat-markings imperfect. Length 5.75–6.00; wing 3.00; tail 2.25–2.50; bill 0.50; tarsus 1.00; middle toe and claw 0.75. Alaska; a beautiful and interesting bird, widely distributed in the Old World.

5. Subfamily REGULINÆ: Kinglets and Wood-Wrens.

The two genera to be here noticed are most readily distinguished by the simple colors of *Phylloscopus*, contrasted with the elegant colored crest of *Regulus;* both genera include very diminutive birds not over five inches long.

9. **PHYLLO'SCOPUS.** (Gr. φύλλον, *phullon*, a leaf; σκοπός, *skopos*, a watchman; as these birds peer about in the foliage.) WOOD-WRENS. Bill shorter than head, slender, straight, depressed at base, compressed and notched at tip; nostrils exposed, though reached by the frontal feathers. Tarsus longer than middle toe and claw, booted or sometimes indistinctly scutellate; wings pointed, longer than tail; point formed by 3d and 4th quills; 5th much shorter, and 6th shorter still, 2d between 5th and 6th; spurious 1st primary very short, exposed less than 0.50. Tail about even. Size diminutive and coloration simple. Includes numerous (about 25) Old World species, one of them occurring in Alaska.

32. **P. borea'lis.** (Lat. *borealis*, northern; *boreas*, the north-wind.) KENNICOTT'S WARBLER. Above, olive-green, clear, continuous, and nearly uniform, but rather brighter on the rump; quills and tail-feathers fuscous, edged externally with yellowish-green; a long yellowish superciliary stripe; under parts yellowish-white, the lining of wings and the flanks yellow; wings crossed with two yellowish bars, that across ends of greater coverts conspicuous, the other indistinct; bill dark brown, pale below; feet and eyes brown. Length 4.75; extent 6.00; wing 2.25–2.50; tail 1.75–2.00; tarsus 0.70; middle toe and claw 0.55. Europe, Asia, and, in America, Alaska.

10. **REG'ULUS.** (Lat. *regulus*, diminutive of *rex*, a king; kinglet.) KINGLETS. Tarsus booted, very slender, longer than the middle toe and claw. Lateral toes nearly equal to each other. First quill of the wing spurious, its exposed portion less than half as long as the second. Wings pointed, longer than the tail, which is emarginate, with acuminate feathers. Bill shorter than the head, straight, slender, and typically Sylviine, not hooked at the end, well bristled at rictus, with the nostrils overshadowed by tiny feathers. Coloration olivaceous, paler or whitish below, with red, black, or yellow, or all three of these colors, on the head of the adult. There are about ten species, of Europe, Asia, and America. They are elegant and dainty little creatures, among the very smallest of our birds excepting the Hummers. They inhabit woodland, are very agile and sprightly, insectivorous, migratory, and highly musical.

33. **R. calen'dula.** (Lat. *calendula*, a glowing little thing.) RUBY-CROWNED KINGLET. ♂ ♀, adult: Upper parts greenish-olive, becoming more yellowish on the rump; wings and tail dusky, strongly edged with yellowish; whole under parts dull yellowish-white, or yellowish- or greenish-gray (very variable in tone); wings crossed with two whitish bars, and inner secondaries edged with the same. Edges of eyelids, lores, and extreme forehead, hoary whitish. A rich scarlet patch, partially concealed, on the crown. This beautiful ornament is apparently not gained until the second year, and there is a question whether it is ever present in the female. Bill and feet black. Length 4.10–4.50; extent 6.66–7.33: wing 2.00–2.33; tail 1.75; bill 0.25; tarsus 0.75. Young for the first year (and ♀ ?): Quite like the adult, but

wanting the scarlet patch. In a newly fledged specimen the wings and tail are as strongly edged with yellowish as in the adult; but the general plumage of the upper parts is rather olive-gray than olive-green, and the under parts are sordid whitish. The bill is light colored at the base, and the toes appear to have been yellowish. N. America at large, breeding far north and in mountains of the West, wintering in the Southern States and beyond. An exquisite little creature, famous for vocal power, abundant in wooded regions. Nest a large mass of matted hair, feathers, moss, straws, etc., placed on the bough of a tree; eggs unknown.

34. R. satra′pa. (Gr. *σατράπης*, Lat. *satrapes*, a ruler; alluding to the bird's golden crown. Fig. 132.) GOLDEN-CRESTED KINGLET. ♂, adult: Upper parts olive-green, more or less bright, sometimes rather olive-ashy, always brightest on the rump; under parts dull ashy-white, or yellowish-white. Wings and tail dusky, strongly edged with yellowish, the inner wing-quills with whitish. On the secondaries, this yellowish edging stops abruptly in advance of the ends of the coverts, leaving a pure blackish interval in advance of the white tips of the greater coverts: this, and the similar tips of the median coverts, form two white bars across the wings; inner webs of the quills and tail-feathers edged with white. Superciliary line and extreme forehead hoary-whitish. Crown black, enclosing a large space, the middle of which is flame-colored, bordered with pure yellow. The black reaches across the forehead; but behind, the yellow and flame-color reach the general olive of the upper parts. Or, the top of the head may be described as a central bed of flame-color, bounded in front and on the sides with clear yellow, this similarly bounded by black, this again in the same manner by hoary-whitish. Smaller than *R. calendula;* overlying nasal plumes larger. Length 4.00; extent 6.50–7.00; wing 2.00–2.12; tail 1.67. ♀, adult; and young: Similar to the adult ♂, but the central field of the crown entirely yellow, enclosed in black (no flame-color). N. America, at large; another exquisite, abundant in woodland and shrubbery, breeding from N. New England northward, wintering in most of the U. S. Nest a ball of moss, hair, feathers, etc., about 4.50 inches in diameter, on low bough of a tree, preferably evergreen; eggs 6–10, white, fully speckled; size 0.50 × 0.40.

FIG. 132. — Golden-crested Kinglet. (After Audubon.)

35. R. s. oliva′ceus? (Lat. *olivaceus*, olivaceous; *oliva*, an olive.) WESTERN GOLDEN-CRESTED KINGLET. A slight variety, said to be of livelier coloration. Pacific coast region.

6. Subfam. POLIOPTILINÆ: Gnat-catchers.

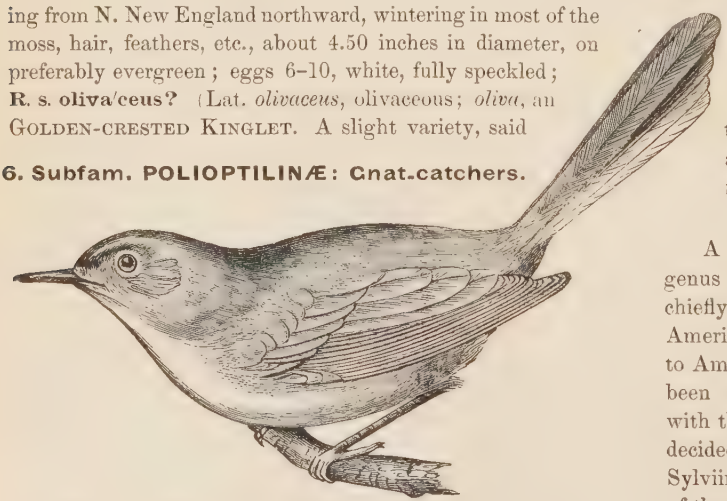

FIG. 133. — Blue-gray Gnat-catcher, nat. size. (Ad nat. del. E. C.)

A small group of one genus and about a dozen, chiefly Central and South American, species; peculiar to America. *Polioptila* has been sometimes associated with the *Paridæ*, but differs decidedly and is apparently Sylviine. Characters those of the single genus.

11. POLIOP'TILA. (Gr. πολιός, *polios*, hoary; πτίλον, *ptilon*, a feather; the primaries being edged with whitish.) GNAT-CATCHERS. Tarsi scutellate. Toes very short, the lateral only about half as long as the tarsus; outer a little longer than the inner. First quill spurious, about half as long as the second. Wings rounded, not longer than the graduated tail, the feathers of which widen toward their rounded ends. Bill shorter than head, straight, broad and depressed at base, rapidly narrowing to the very slender terminal portion, distinctly notched and hooked at the end — thus Muscicapine in character. Rictus with well-developed bristles. Nostrils entirely exposed. Coloration without bright tints; bluish-ash, paler or white below; tail black and white. Delicate little woodland birds, peculiar to America, not over 5 inches long; migratory, insectivorous, very active and sprightly, with sharp squeaking notes.

Analysis of Species.

♂ Forehead and line over eye black; outer tail-feather white . . . . . *cærulea* 36
♂ Whole crown black; outer web of outer tail-feather only edged with white . . . . . *melanura* 37
♂ Line over eye black; outer web of outer tail-feather white . . . . . *plumbea* 38

36. P. cærul'ea. (Lat. *cærulea*, cerulean, blue. Figs. 133, 134, *b*.) BLUE-GRAY GNAT-CATCHER. ♂, adult: Grayish-blue, bluer on the crown, hoary on the rump, the forehead black, continuous with a black superciliary line. Edges of eyelids white, and above these a slight whitish stripe bordering the black exteriorly. Below white, with a faint plumbeous shade on the breast. Wings dark brown, the outer webs, especially of the inner quills, edged with hoary, and the inner webs of most bordered with white. Tail jet-black, the outer feather entirely or mostly white, the next one about half white, the third one tipped with white. Bill and feet black. Length 4.50–5.00; extent 6.25–7.00; wing 2.00–2.20; tail about the same. ♀: Like the ♂, but duller and more grayish-blue above; the head like the back, and without any black. Bill usually in part light-colored. U. S. from Atlantic to Pacific, N. to Massachusetts; breeds throughout its range, and winters on the southern border and southward; abundant in woodland. Nest a model of bird-architecture, compact-walled and contracted at the brim, elegantly stuccoed with lichens, fixed to slender twigs at a varying height from 10 to 50 or 60 feet; eggs 4–5, about 0.60 × 0.45, whitish, fully speckled with reddish and umber-brown and lilac.

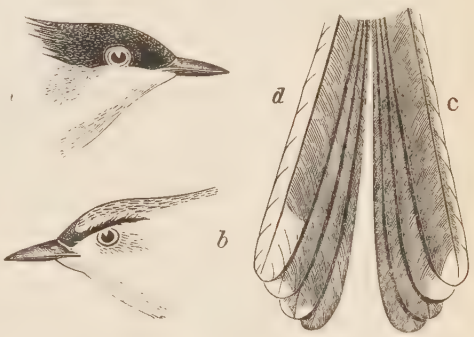

FIG. 134. — *a*, head of *Polioptila melanura*; *b*, of *P. cærulea*; *c*, tail of *P. melanura*; *d*, of *P. plumbea*; all nat. size.

37. P. melanu'ra. (Gr. μέλας, *melas*, black; οὐρα, *oura*, tail. Fig. 134, *a*, *c*.) BLACK-CAPPED GNAT-CATCHER. ♂: Like *P. cærulea*, but whole top of head black. White of tail reduced to a minimum; outer web of the outer feather only edged with white, instead of wholly white; tip of the inner web, with tip of the next feather, white for a very slight space; no white on the third feather. Size of the foregoing; tarsi rather longer, — about 0.70. ♀: No black on the head; distinguished from ♀ *cærulea* only by less white on the tail. Texas to South and Lower California.

38. P. plum'bea. (Lat. *plumbeus*, plumbeous, lead-colored. Fig. 134, *d*.) PLUMBEOUS GNAT-CATCHER. ♂, adult: Upper parts like those of *P. cærulea*, but duller and more grayish; no black on forehead; a short black stripe over eye, and below this a white one. Outer tail-feather with the whole outer web and tip white (like the *second* feather of *P. cærulea*); next two feathers tipped with white. Size of *P. cærulea*. ♀: Like the ♂; the upper parts still duller, and frequently with a decided brownish shade; no black over eye; thus only distinguished from ♀ *cærulea* by less white on the tail. Valley of the Gila and Colorado.

Obs. According to Brewster, Bull. Nutt. Club, vi, 1881, p. 101, the two foregoing are adult (No. 37) and young (No. 38) of the same species, which is *plumbea*, Bd., Pr. Phila. Acad., 1854, p. 118; B. N. A., 1858, p. 382, and authors; *melanura*, Lawr., Ann. Lyc. N. Y., vi, 1856, p. 168, but not of authors referring to the Californian bird; also, *atricapilla*, Lawr., Ann. Lyc. N. Y., v, 1851, p. 124: Cass., Ill., 1854, pl. 27, but not of Swainson. Brewster describes the Californian bird as a new species, as follows: — P. CALIFORNICA. *California Black-capped Gnat-catcher.* ♂: As compared with *P. plumbea*, upper parts decidedly plumbeous instead of bluish; throat, breast, and sides dull ashy instead of ashy-white; lower belly and crissum fulvous or even pale chestnut; light edging of the tail-feathers confined to outer pair, with sometimes slight tipping of next pair (as in my fig. 134, *c*.); lining of wings pearly-ash, not white: secondaries and tertials edged with light brown. No pure white anywhere; general aspect of under parts nearly as dark as those of a cat-bird. Whole crown glossy black. Length 4.50; extent 6.10; wing 1.84; tail 1.80: tarsus 0.73; bill 0.50. ♀: Similar, but no black on crown; belly and crissum pale chestnut; outer webs of second pair of rectrices edged with white. California; being the *melanura* of authors referring to California birds, but not of Lawr., 1856.

2. Family CHAMÆIDÆ: Wren-tits.

Recently framed for a single species, much like a titmouse in general appearance, but with the tarsus not evidently scutellate in front; rounded wings much shorter than the graduated tail; lores bristly, and plumage extraordinarily soft and lax. With the general habits of wrens, with which the species was formerly associated. The position and valuation of the group are still uncertain; probably to be determined upon anatomical characters. I have little doubt that *Chamæa* will yet be found referable to some other recognized family of birds, and suspect that it might be assigned to the Old World *Timeliidæ*, with at least as much propriety as some other American groups, which have lately been relegated to that ill-assorted assemblage.

12. **CHAMÆ'A.** (Gr. χαμαί, *chamai*, on the ground.) WREN-TITS. Form and general aspect combining features of wrens and titmice. Plumage extraordinarily lax, soft, and full. Coloration simple. Tarsal scutella obsolete, or faintly indicated, at least outside. Toes coherent at base for about half the length of the proximal joint of the middle one. Soles widened and padded, much as in *Paridæ*. Primaries 10, the 6th longest, the 3d equal to the longest secondaries, the 1st about three-fifths as long as the longest; wing thus extremely rounded, and much shorter than the tail (about two-thirds as long). Tail very long, constituting more than half the entire length of the bird, extremely graduated, with soft, narrow feathers, widening somewhat toward their tips, rounded at the end, the lateral pair not two-thirds as long as the middle. Bill much shorter than head, very deep at the base, straight, stout, compressed-conical, not notched, with ridged and very convex culmen, but nearly straight commissure and gonys: naked, scaled, linear nostrils, and strongly bristled gape. Frontal feathers reaching nasal fossæ, but no ruff concealing the nostrils as in *Paridæ*.

39. **C. fascia'ta.** (Lat. *fasciata*, striped; *fascis*, a bundle of faggots.) WREN-TIT. Adult: Dark brown with an olive shade, the top of the head clearer and somewhat streaky, the wings and tail purer brown, obscurely fasciated with numerous cross-bars; below, dull cinnamon-brown, paler on belly, shaded with olive-brown on the sides and crissum, the throat and breast obscurely streaked with dusky; bill and feet brown; iris white. Length about 6.00; wing 2.25–2.50: tail 3.25–3.50, much graduated, the lateral feathers being an inch or more shorter than the middle ones; bill 0.40; tarsus 0.90–1.00; middle toe and claw 0.75. First primary nearly an inch shorter than the longest one. California coast region. A remarkable bird, resembling no other, common in shrubbery; nest in bushes; eggs plain greenish-blue, 0.70 × 0.52.

39a. **C. f. henshawi.** (To H. W. Henshaw.) HENSHAW'S WREN-TIT. Much lighter and duller colored; above, grayish-ash with slight olive shade (about the color of a *Lophophanes*); below, scarcely rufescent upon a soiled whitish ground, shaded on the sides with the color of the back; bill and feet smaller. Interior of California, and probably adjoining regions; seems to be a well-marked form. (Not in the Check List, 1882; see Ridgway, Pr. U. S. Nat. Mus. v., 1882, p. 13.)

3. Family PARIDÆ: Titmice, or Chickadees.

FIG. 135. — European Greater Titmouse, *Parus major*. (From Dixon.)

Ours are all small (under 7 inches long) birds, at once distinguished by having ten primaries, the 1st much shorter than the 2d; wings barely or not longer than the tail; tail-feathers not stiff nor acuminate; tarsi scutellate, longer than the middle toe; anterior toes much soldered at base; nostrils concealed by dense tufts, and bill compressed, stout, straight, unnotched, and much shorter than the head; — characters that readily marked them off from all their allies, as wrens, creepers, etc. Really, they are hard to distinguish, technically, from jays; but all our jays are much over 7 inches long.

They are distributed over North America, but the crested species are rather southern, and all but one of them western. Most of them are hardy birds, enduring the rigors of winter without inconvenience, and, as a consequence, none of them are properly migratory. They are musical, after a fashion of their own, chirping a quaint ditty; are active, restless, and very heedless of man's presence; and eat everything. Some of the western species build astonishingly large and curiously shaped nests, pensile, like a bottle or purse with a hole in one side, as represented in fig. 140; others live in knot-holes, and similar snuggeries that they usually dig out for themselves. They are very prolific, laying numerous eggs, and raising more than one brood a season; the young closely resemble the parents, and there are no obvious seasonal or sexual changes of plumage. All but one of our species are plainly clad; still they have a pleasing look, with their trim form and the tasteful colors of the head.

7. Subfamily PARINÆ: True Titmice.

Exclusive of certain aberrant forms, usually allowed to constitute a separate subfamily, and sometimes altogether removed from *Paridæ*, the titmice compose a natural and pretty well defined group, to which the foregoing diagnosis and remarks are particularly applicable, and agree in the following characters: — Bill very short and stout, straight, compressed-conoid in shape, not notched nor with decurved tip, its under as well as upper outline convex. Rictus without true bristles, but base of the bill covered with tufts of bristly feathers directed forward, entirely concealing the nostrils. Feet stout; tarsi distinctly scutellate, longer than the middle toe; toes rather short, the anterior soldered together at the base for most of the length of the basal joint of the middle one. Hind toe with an enlarged pad beneath, forming, with the consolidated bases of the anterior toes, a broad firm sole. Wing with ten primaries, of which the first is very short or spurious, scarcely or not half as long as the second; wing as a whole rounded, scarcely or not longer than the tail, which latter is rounded or graduated, and composed of twelve narrow soft feathers, with rounded or somewhat truncated tips. Plumage

long, soft, and loose, without bright colors or well-marked changes according to sex, age, or season (excepting *Auriparus*).

There may be about seventy-five good species of the *Parinæ*, thus restricted, most of them falling in the genus *Parus*, or in its immediate neighborhood. With few exceptions they are birds of the northern hemisphere, abounding in Europe, Asia, and North America. The larger proportion of the genera and species inhabit the Old World. All those of the New World occur within our limits.

Analysis of Genera.

Crested.
- Wings and tail rounded, of about equal lengths. No red or yellow. . . . . *Lophophanes* 13

Not crested.
- Wings and tail rounded, of about equal lengths. No red or yellow . . . . . *Parus* 14
- Wings rounded, shorter than the graduated tail. No red or yellow . . . . . *Psaltriparus* 15
- Wings pointed, longer than the even tail. Head yellow ; bend of wing red . . . . . *Auriparus* 16

13. LOPHO'PHANES. (Gr. λόφος, *lophos*, a crest; φαίνω, *phaino*, I appear.) Crested Titmice. Head crested. Wings and tail rounded, of about equal lengths, and about as long as the body. Bill conoid-compressed, with upper and under outlines both convex. No yellow on head nor red on wing. Plumage lax, much the same in both sexes at all ages and seasons. Average size of the species at a maximum for *Parinæ*. Nests excavated in trees; eggs spotted.

Analysis of Species.

- Frontlet black ; sides washed with rusty. Eastern . . . . . *bicolor* 40
- Crest like rest of upper parts ; no rusty on sides. Southwestern . . . . . *inornatus* 41
- Crest entirely black ; rusty on sides. Texan . . . . . *atrocristatus* 42
- Head with several black stripes ; no rusty on sides. Southwestern . . . . . *wollweberi* 43

40. L. bi'color. (Lat. *bis*, twice; *color*, color. Fig. 136.) Tufted Titmouse. ♂ ♀, adult: Entire upper parts ashy, the back usually with a slight olivaceous shade, the wings and tail rather purer and darker plumbeous, the latter sometimes showing obsolete transverse bars. Sides of the head and entire under parts dull whitish, washed with chestnut-brown on the sides. A black frontlet at the base of the crest. Bill plumbeous-blackish ; feet plumbeous. Length 6.00–6.50 inches ; extent 9.75–10.75 ; wing and tail 3.00–3.25 ; bill 0.40 ; tarsus 0.80 ; middle toe and claw 0.75. ♀ smaller than ♂. Young: The crest less developed ; little if any trace of the black frontlet ; sides scarcely washed with rusty. Eastern U. S., rather southerly ; scarcely N. to New England ; resident, abundant in woodland and shrubbery. Nest in holes ; eggs 6 or 8, 0.75 × 0.56, white, dotted with reddish-brown and lilac.

Fig. 136. — Tufted Titmouse, nat. size. (Ad nat. del. E. C.)

41. L. inorna'tus. (Lat. *in*, as signifying negation, and *ornatus*, adorned ; *orno*, I ornament.) Plain Titmouse. ♂ ♀, adult: Entire upper parts dull leaden-gray, with a slight olive shade ; the wings and tail rather purer and darker. Below, dull ashy-whitish, without any rusty wash on the sides. No black on the head. Extreme forehead and sides of the head obscurely speckled with whitish. No decided markings anywhere. In size rather less than *L. bicolor;* length usually under 6.00 ; wing and tail under 3.00. Young quite like the adults, which closely resemble the young of *L. bicolor;* but in the latter there are traces at least of the reddish of the sides or black of the frontlet, or both ; the general coloration is purer, with more distinction between the upper and under parts, and the size is rather greater. The speckled appearance of the sides of the head and lores of *L. inornatus* is peculiar. Southwestern United States, abundant, resident. The typical form Californian ; a rather larger, stouter-billed form, lighter leaden-gray with scarcely any olive shade, from Utah, Arizona, etc., is *L. i. griseus*, Ridgw., Pr. U. S. Nat. Mus., v., 1882, p. 344.

42. L. atrocrista'tus. (Lat. *atro*, with black, *cristatus*, crested; *crista*, a crest.) BLACK-CRESTED TITMOUSE. ♂ ♀, adult: Plumbeous, with a shade of olive, the wings and tail rather darker and purer, edged with the color of the back, or a more hoary shade of the same. Beneath, dull ashy-whitish, especially on the breast, the abdomen whiter, the sides chestnut-brown as in *L. bicolor*. Extreme forehead and lores whitish; entire crest glossy black. Bill blackish-plumbeous; feet plumbeous. Small: length about 5.00; wing and tail 2.75. Valley of the Rio Grande. Nest in natural cavities of trees, usually including cast snake-skins among its materials; eggs 0.75 × 0.58, white, spotted with reddish-brown in fine dots over the general surface, boldly blotched at large end, but not distinguishable from those of *L. bicolor*.

43. L. wollweb'eri. (To one Wollweber. Fig. 137.) BRIDLED TITMOUSE. ♂ ♀, adult: Upper parts olivaceous-ash, wings and tail darker, edged with the color of the back, or even a brighter tint, sometimes nearly as yellowish as in *Regulus*. Under parts sordid ashy-white. Crest black, with a central field like the back. Whole throat black, as in species of *Parus*. A black line runs behind the eye and curves down over the auriculars, distinguished from the black of the crest and throat by the white of the side of the head and white superciliary stripe; a half-collar of black on the nape, descending on the sides of the neck, there separated from the black crescent of the auriculars by a white crescent, which latter is continuous with the white of the superciliary line; considerable whitish speckling in the black of the forehead and lores. Bill blackish-plumbeous; feet plumbeous. Smallest: length 5.00 or less; wing or tail 2.40-2.65; bill 0.33; tarsus 0.60–0.70. Young: Chin narrowly or imperfectly black, and some of the above described head-markings obscure or incomplete. The singularly variegated markings of the head of this species at once distinguish it. Texas, New Mexico, Arizona, and California, abundant, going in troops, in woods and shrubbery.

FIG. 137. — Bridled Titmouse, nat. size. (Mex. B. Survey.)

14. PA'RUS. (Lat. *parus*, a titmouse.) TYPICAL TITMICE. CHICKADEES. Head not crested. Wings and tail rounded, of approximately equal lengths, and about as long as the body. Bill typically parine (see foregoing characters). No bright colors (in any North American species). Head in most species with black. Plumage lax and dull, without decided changes with age, sex, or season. Size medium in the family. Nest excavated. Eggs spotted.

Analysis of Species.

Species definitely black-capped and black-throated.
- A white superciliary stripe . . . . . *montanus* 48
- No white superciliary stripe.
  - Tail not shorter than wing; feathers of both with much hoary-whitish edging.
    - Larger; tail at maximum length, coloration most hoary. Missouri Region and Rocky Mts. . . . . *septentrionalis* 45
    - Smaller; tail moderate; coloration less hoary. Eastern . . . . . *atricapillus* 44
    - Size of No. 44; coloration darker. Pacific Region . . . . . *occidentalis* 46
  - Tail shorter than wings; whitish edgings of wings and tail obsolete.
    - Rather smaller than No. 44. South Atlantic States . . . . . *carolinensis* 47
    - Rather smaller than No. 44; coloration very dark. Mexican border . . . *meridionalis* 879

Species brown-capped, or crown quite like back, and blackish throat.
- Cap hair-brown; back little different.
  - White confined to side of head. Eastern and Arctic . . . . . *hudsonicus* 49
  - White spreading over sides of neck. Arctic . . . . . *cinctus* 52
- Cap dark wood-brown; back chestnut.
  - Back and sides rich chestnut alike. Pacific, northerly . . . . . *rufescens* 50
  - Back chestnut, but sides only washed with rusty. Pacific, southerly . . . . . *neglectus* 51

44. P. atricapil'lus. (Lat. *ater*, black; *capillus*, hair. Fig. 138.) BLACK-CAPPED TITMOUSE. CHICKADEE. Crown and nape, with chin and throat, black, separated by white sides of the head. Upper parts brownish-ash, with slight olive tinge, and a rusty wash on rump. Under

parts more or less purely white or whitish, shaded on the sides with a brownish or rusty wash. Wings and tail like upper parts, the feathers moderately edged with hoary-white. Average dimensions: length 5.25; extent 8.00; wing and tail, each, 2.50; tarsus 0.70. Extremes: length 4.75–5.50; extent 7.50–8.50; wing and tail 2.35–2.65; tarsus 0.65–0.75. Eastern N. Am., from the Middle States northward, very abundant, well-known by its familiar habits and peculiar notes. Nest in holes of trees, stumps, or fences, natural or excavated by the bird, made of grasses, mosses, hair, fur, feathers, etc.; eggs 6–8, 0.58 × 0.47, white, fully sprinkled with reddish-brown dots and spots.

Fig. 138. — Black-capped Chickadee, reduced. (Ad nat. del. E. C.)

45. P. a. septentriona/lis. (Lat. *septentrionalis*, northern; *septentriones*, the constellation of seven stars, the dipper.) Long-tailed Chickadee. Similar to *P. atricapillus;* averaging larger, and especially longer-tailed, the tail rather exceeding the wing in length. Coloration clear and pure; wings and tail very strongly edged, especially on the secondaries and outer tail-feathers, with hoary-white, which usually passes entirely around their tips. Cap pure black and very extensive on the nape; black of throat reaching breast; sides of head and neck snowy-white. Bill and feet dark plumbeous. Average dimensions about the maxima of *P. atricapillus:* length 5.25–5.50; extent 8.50; wing 2.50–2.75; tail 2.60–2.80, sometimes 3.00. This style reaches its extreme development in the region of the Upper Missouri and Rocky Mts., there apparently to the exclusion of *P. atricapillus* proper.

46. P. a. occidenta/lis. (Lat. *occidentalis*, western; *occido*, I fall; i. e., where the sun sets.) Western Chickadee. Similar to *P. atricapillus;* of the same average size; presenting the opposite extreme from *P. septentrionalis* in minimum edging of wing- and tail-feathers with hoary, heavy brownish wash of sides, and general dark sordid coloration. U. S., Pacific coast region.

47. P. carolinen/sis. (Lat. of Carolina.) Carolina Chickadee. Averaging smaller than *P. atricapillus*, with relatively as well as absolutely shorter tail, which is rather shorter than the wings; wings and tail very little edged with whitish. Average dimensions about at the minima of *P. atricapillus.* Length about 4.50; wing 2.50; tail 2.25. South Atlantic and Gulf States; N. to Washington and Southern Illinois. Nesting like *P. atricapillus;* eggs similar, rather smaller.

879. P. meridiona/lis. (Lat. *meridionalis*, southern.) Mexican Chickadee. Differs decidedly from *P. atricapillus* in having the under parts merely a paler shade of the ashy of the upper, instead of white, without any brownish wash on sides; wing-coverts and tail lacking any hoary edging, though the wing-quills have a slight grayish-white edging. Thus quite like *P. montanus* in color, but no white superciliary stripe. Length 4.80–5.20; extent 8.00–8.70; wing 2.67–2.90; tail 2.40–2.67. Mexico, recently ascertained to occur in Arizona. (Numbered among addenda in the Check List, 1882.)

Fig. 139. — Mountain Chickadee, nat. size. (Ad nat. del. E. C.)

48. P. monta/nus. (Lat. *montanus*, of mountains. Fig. 139.) Mountain Chickadee. Upper parts ashy-gray, with scarcely a shade, and only on the rump, of the ochraceous seen in most other species; under parts similarly grayish-white, without a rusty tinge, the middle of the

belly nearly white, the rest more heavily shaded. Wings and tail with comparatively little whitish edging—the tail at least with no more than that of *P. carolinensis*. Sides of the head and neck white; top of the head, and the throat, black. A conspicuous white superciliary stripe in the black cap, usually meeting its fellow across the forehead. Length about 5.00; extent 8.30; wing 2.50–2.75; tail rather less; bill 0.38; tarsus 0.66. U. S., from Eastern foot-hills of the Rocky Mts. to the Pacific, chiefly in alpine regions.

50. **P. rufes'cens.** (Lat. *rufescens*, rufous, reddish.) CHESTNUT-BACKED TITMOUSE. Crown and nape dark wood-brown, becoming sooty along the sides, separated from the sooty-black of the throat by a large white area extending back on the sides of the neck. Entire back and sides of body rich dark chestnut, contrasting strongly with the brown of the head. Breast and central line of under parts, with lining of the wings, whitish. Wing- and tail-coverts more or less washed with rusty-brown. Quills and tail-feathers scarcely or slightly edged with whitish. Bill black; feet dark; iris brown. Young with throat brown, like crown, instead of sooty. Length 4.75; extent 7.50; wing 2.30; tail about 2.00. A strongly marked species, with chestnut back and sides contrasting with dark brown cap and sooty throat. Pacific coast region of the U. S., northerly, and corresponding portions of British America.

51. **P. r. neglec'tus?** (Lat. *neglectus*, neglected, i. e., not chosen; *nec*, not, and *lego*, I gather, choose.) Quite similar: crown, throat, and back the same, but sides not extensively chestnut, being simply washed with rusty-brown. Coast region of California.

49. **P. hudson'icus.** (Lat. *hudsonicus*, of Hudson's Bay; after Henry Hudson, the navigator.) HUDSONIAN TITMOUSE. Crown, nape, and upper parts generally clear hair-brown, or ashy-brown with a slight olive shade, the coloration quite the same on back and crown, and continuous, being not separated by any whitish nuchal interval. Throat quite black, in restricted area, not extending backward on sides of neck; separated from the brown crown by silky white on the side of the head, this white not reaching back of the auriculars to the sides of the nape. Sides, flanks, and under tail-coverts washed with dull chestnut or rusty-brown; other under parts whitish. Quills and tail-feathers lead-color, as in other titmice, scarcely or slightly edged with whitish. Little or no concealed white on rump. Bill black; feet dark. Size of *P. atricapillus*, or rather less. Wing 2.50; tail rather less. New England and British America generally; Nevada to Alaska. Common in coniferous woods.

49a. **P. h. evu'ra**, *nobis*. Alaskan specimens are larger, the tail nearly 3.00; thus corresponding with *P. atricapillus septentrionalis*, and being quite the size of *P. cinctus*, from which distinguished by retaining precisely the coloration of *P. hudsonicus*. Alaska.

52. **P. cinc'tus.** (Lat. *cinctus*, girdled; *cingo*, I bind about.) SIBERIAN TITMOUSE. In general, similar to *P. hudsonicus*, but quite distinct. Throat sooty-blackish; crown and nape dark hair-brown, bordered laterally with dusky, quite appreciably different in tone from the brighter brownish of the back, from which also separated to some extent by whitish of the cervix. Sides of head and neck pure white, in a large area widening behind, this white of opposite sides nearly meeting across the cervix. Back ashy overlaid with flaxen-brown, the rump light brown with much concealed white. Under parts whitish centrally from the black throat, but heavily washed on the sides, flanks, and crissum, sometimes quite across the belly, with light brownish. Wings and tail slate-color, as usual in the genus, with much whitish edging, especially on the secondaries. Bill plumbeous-blackish; feet plumbeous. Wing 2.60; tail rather more. A large stylish chickadee, lately ascertained to inhabit Arctic America, especially Alaska, as well as boreal regions of Asia and Europe.

15. **PSALTRI'PARUS.** (Gr. ψάλτρια. Lat. *psaltria*, a lutist; and *parus*, a tit.) BUSH-TITS. Dwarfs among pygmies! 3.75–4.25 long; wing 2.00 or less, tail 2.00 or more. Ashy or olive-gray, paler or whitish below; neither crown nor throat black; no bright colors. Head not crested; wings rounded, shorter than the long narrow graduated tail, which exceeds the length of the body. Nest large, woven, pensile, with lateral entrance (fig. 140). Eggs 6–9,

white, unmarked. The three species are western; they are notable for their diminutive size, scarcely equalling a *Polioptila* in bulk.

Analysis of Species.

Crown brown, unlike back; no black on side of head . . . . . *minimus* 53
Crown like back; no black on side of head . . . . . *plumbeus* 54
Crown ash, unlike back; a black stripe on side of head . . . . . *melanotis* 55

53. P. min'imus. (Lat. *minimus*, least, smallest.) Least Bush-tit. ♂ ♀: Dull lead-color, frequently with a brownish or olivaceous shade, the top of the head abruptly darker — clove-brown or hair-brown. Below sordid whitish, or brownish-white. Wings and tail dusky, with slight hoary edgings. Bill and feet black. Length 4.00 or less; wing scarcely or not 2.00; tail 2.00 or more; bill 0.25; tarsus 0.60. Young birds do not differ materially. There is considerable variation in the precise shade of the body, but the brown cap always differs in color from the rest of the upper parts. Pacific coast region of the U. S.

Fig. 140. — Least Bush-tit and nest, about ⅔ nat. size. (Ad nat. del. H. W. Elliott.)

54. P. plum'beus. (Lat. *plumbeus*, lead-colored.) Plumbeous Bush-tit. ♂ ♀: Clear plumbeous, with little or no olive or brownish shade; top of head not different from the back; sides of head pale brownish. Under parts as in *P. minimus*, but clearer. Tail longer than wings. Eyes yellow or dark brown. Length about 4.25; wing 1.88–2.12; tail 2.25–2.50; bill 0.25; tarsus 0.60. Very closely related to *P. minimus;* but specimens are readily distinguishable. Total length greater, owing to elongation of the tail, which sometimes exceeds the wings by 0.50. General coloration clearer and purer; crown not different in color from the back, but cheeks brownish in obvious contrast. Southern Rocky Mt. region, from Wyoming and Nevada southward; common in Arizona.

55. P. melano'tis. (Gr. *μέλας*, *melas*, gen. *μέλανος*, *melanos*, black; *οὖς*, *ous*, gen. *ὠτός*, *otos*, ear.) Black-eared Bush-tit. ♂, adult: Sides of head broadly black with greenish lustre, the

bands meeting narrowly across the chin, and nearly meeting on the nape. Crown and nape clear ash. Back hair-brown. Wings and tail fuscous, with narrow pale ashy edgings of the feathers; outer webs and tips of outer tail-feathers, and inner webs of many wing-feathers, whitish. Below, white, pure on throat and sides of neck, thence passing through lavender-gray to rusty-brownish on flanks and crissum. Bill and feet black; iris brown. ♀ unknown: probably not different. Young quite similar, having glossy black on the head before they are fully feathered, but the black does not at first meet on the chin. Length about 4.00; wing 1.90; tail 2.25; bill 0.25, compressed, with very convex culmen and nearly straight under outline; tarsus 0.60; middle toe and claw 0.45. A neat little tom-thumb, native of Mexico, N. to Arizona and probably farther, rare; I have seen but three specimens.

16. **AURIPARUS.** (Lat. *auri*, of gold, and *parus*, a tit; from the yellow head.) GOLD-TITS. Head not crested. Wings pointed, the 2d quill being little shorter than the 3d; the 1st spurious. Tail little rounded, decidedly shorter than the wings. Bill not typically parine — extremely acute, with straight or slightly concave under outline, and barely convex culmen, thus resembling that of a *Helminthophaga;* longer and slenderer than usual in *Parinæ;* nostrils scarcely concealed by the imperfect ruff. Tarsi relatively shorter than in the preceding genera. Bright colors on head (yellow) and wing (red). Plumage comparatively compact; sexes alike, but young very different from the adult. Size very small. General form sylvicoline. Nest globular, woven. Eggs spotted. One species.

56. **A. flaviceps.** (Lat. *flaviceps*, yellow-head.) GOLD-TIT. ♂ ♀: Upper parts ashy; under parts whitish; wings and tail dusky, with hoary edging. Whole head rich yellow. Lesser wing-coverts chestnut-red. Bill dark plumbeous; feet plumbeous. Length 4.00–4.25; wing 1.80–2.00; tail 1.75–2.25. Young without red on wing or yellow on head; thus obscure objects, known, however, by their generic characters. Adults vary in having the yellow heightened to orange, or dull and greenish; the red sometimes hæmatitic; and the shade of the ashy clear and pure, or dull and brownish. Valley of the Rio Grande and Colorado, and Lower California; abundant in chaparral, building in bushes a great globular nest of twigs, lined with down and feathers; eggs 4–6, pale bluish speckled with brown, 0.60 × 0.45.

4. Family SITTIDÆ: Nuthatches.

Bill subcylindrical, tapering, compressed, slender, acute, nearly or about as long as the head, culmen and commissure about straight, gonys long, convex, ascending (giving a sort of recurved look to a really straight bill). Nostrils rounded, concealed by bristly tufts. Wings long, pointed, with 10 primaries, the 1st very short or spurious; tail much shorter than wings, broad, soft, nearly even; tarsus shorter than the middle toe and claw, scutellate in front; toes all long, with large, much curved, compressed claws; 1st toe and claw about equal to the 3d; 2d and 4th toes very unequal in length. Plumage compact; body flattened; tongue horny, acute, barbed. Nuthatches are amongst the most nimble and adroit of creepers; they scramble about and hang in every conceivable attitude, head downwards as often as otherwise. This is done, too, without any help from the tail, — the whole tarsus being often applied to the support. They are chiefly insectivorous, but feed also on hard fruits; and get their English name from their habit of sticking nuts and seeds in cracks in bark, and hammering away with the bill till they break the shell. They are very active and restless little birds, quite sociable, often going in troops, which keep up a continual noise; lay 4–6 white, spotted eggs, in hollows of trees. The family, as conventionally framed, is a small one, of less than thirty species, among them a single remarkable Madagascar form (*Hypositta*), a genus peculiar to Australia (*Sittella*), and another confined to New Zealand (*Acanthisitta*): but some of these (especially *Acanthisitta*) may not be *Sittidæ* at all, and in any event the family is chiefly represented by the genus *Sitta*, with some fifteen species of Europe, Asia, and North America.

17. SITTA. (Lat. *sitta*, Gr. *σίττα*, name of a bird. Fig. 141.) TYPICAL NUTHATCHES. Characters practically those given under head of the family.

Analysis of Species and Varieties.

White below, the crissum washed with rusty-brown ; cap glossy black, without stripes.
Bill stouter, 0.18-0.20 deep at base Inner secondaries boldly variegated with black. Eastern *carolinensis* 57
Bill slenderer, 0.12-0.16 deep at base. Inner secondaries scarcely variegated with blackish. Western *aculeata* 58
Rusty-brown below ; cap glossy black with white stripes, or color of the back . . . . . *canadensis* 59
Rusty-brown or brownish-white below ; cap brown, unlike back, without stripes.
Crown clear hair-brown ; a white spot on nape ; middle tail-feathers plain. Southeastern . *pusilla* 60
Crown dull brownish, with darker border ; little or no white on nape ; middle tail-feathers with black. Southwestern . . . . . *pygmæa* 61

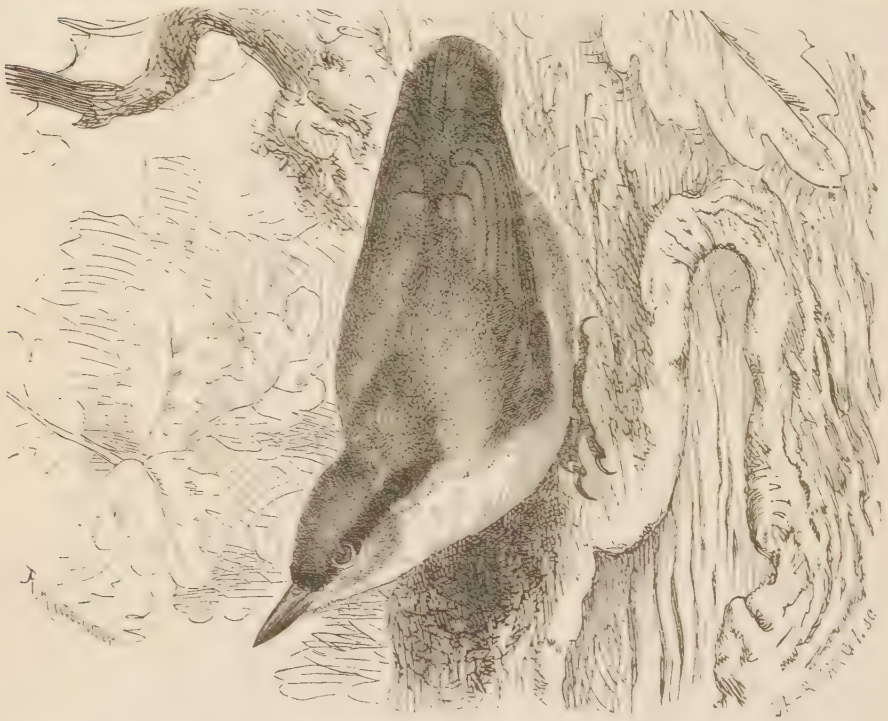

FIG. 141. — European Nuthatch, *Sitta cæsia* (resembling *S. pusilla*), nearly nat. size. (From Brehm.)

57. S. carolinen'sis. (Lat. of Carolina. Fig. 142.) CAROLINA NUTHATCH. WHITE-BELLIED NUTHATCH. ♂. adult: Upper parts, central tail-feathers, and much edging of the wings, clear ashy-blue : whole crown, nape, and back of the neck, glossy black. Under parts, including sides of neck and head to above eyes, dull white, more or less marked on the flanks and crissum with rusty-brown. Wings and their coverts blackish, much edged as already said, and with an oblique bar of white on the outer webs of the primaries towards their ends; concealed bases of primaries white; under wing-coverts mostly blackish; bold bluish and black variegation of the inner secondaries. Tail,

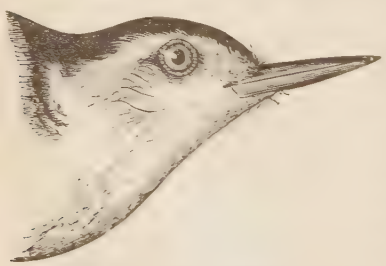

FIG. 142. — Carolina Nuthatch, nat. size. (Ad nat. del. E. C.)

excepting the two middle feathers, black, each feather marked with white in increasing amount, the outer web of the lateral feather being mostly white. Bill blackish-plumbeous, pale at the base below. Feet dark brown. Iris brown. Length 5.50–6.00; extent 10.50–11.00; wing 3.50; tail 1.75; bill about 0.66 long, 0.18–0.20 deep at base. ♀: Similar; black of head imperfect, mixed or overlaid with the color of the back, or altogether restricted to the nape. Eastern U. S. and British Provinces, resident, abundant in woodland, where its curious *quank, quank, quank* may often be heard as the nimble bird hops up and down the tree-trunks. Nest in holes, often excavated by the birds with infinite labor, lined with fur, feathers, grasses, etc.; eggs numerous, 0.80 × 0.60, white, profusely speckled with reddish and lilac.

58. S. c. aculea'ta. (Lat. *aculeata*, sharpened; referring to the slender bill.) SLENDER-BILLED NUTHATCH. Like the last; bill slenderer, 0.12–0.16 deep at base. Inner secondaries scarcely or not variegated with blackish, and general tone of coloration duller. Woodland of Middle and Western provinces of the U. S., common, replacing No. 57.

59. S. canaden'sis. (Lat. of Canada, an Iroquois word. Fig. 143.) RED-BELLIED NUTHATCH. CANADA NUTHATCH. ♂, adult: Upper parts leaden-blue (brighter than in *S. carolinensis*), the central tail-feathers the same; wings fuscous, with slight ashy edgings and concealed white bases of the primaries. Entire under parts rusty-brown, very variable in shade, from rich fulvous to brownish-white, usually palest on the throat, deepest on the sides and crissum; tail-feathers, except the middle pair, black, the lateral marked with white. Whole top and side of head and neck glossy black, that of the side appearing as a broad bar through the eye from bill to side of neck, cut off from that of the crown by a long white superciliary stripe, which meets its fellow across the forehead. Bill dark plumbeous, paler below; feet plumbeous-brown. Length 4.50–4.75; extent 8.00–8.50; wing 2.60; tail 1.50; bill 0.50. ♀: Crown like the back; lateral stripe on the head merely blackish. The under parts average paler than those of the ♂, but there is no constancy about this. Young birds resemble the ♀. Temperate N. Am., common, in woodland; habits like those of No. 57; eggs similar, smaller, 0.65 × 0.54.

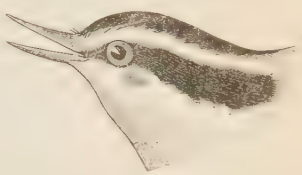

FIG. 143. — Canada Nuthatch, nat. size. (Ad nat. del. E. C.)

60. S. pusil'la. (Lat. *pusilla*, puerile, petty. Fig. 144.) BROWN-HEADED NUTHATCH. ♂ ♀: No black cap or white stripe on head. Upper parts dull ashy-blue; under parts sordid or muddy whitish. Cap clear hair-brown. A decided spot of white on the middle of the nape, in the brown cap, which on the sides of the head includes the eyes, and is bordered with dusky. Middle tail-feathers like back, without black, and with little or no white. Small: length scarcely 4.00; extent about 8.00; wing 2.50; tail 1.25; tarsus 0.60; bill about 0.50. South Atlantic and Gulf States; N. to Virginia and Ohio. Habits of the other species: eggs 0.60 × 0.50, very heavily speckled with dark reddish-brown.

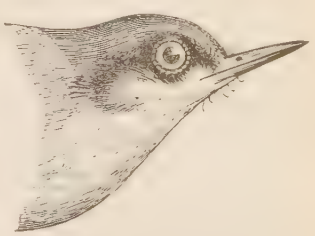

FIG. 144. — Brown-headed Nuthatch, nat. size. (Ad nat. del. E. C.)

61. S. pygmæ'a. (Gr. πυγμή, *pugme*, the fist; Lat. *pygmæus*, a pygmy, fistling, or tom-thumb.) PYGMY NUTHATCH. ♂ ♀: Upper parts ashy-blue, and wings with slight if any markings (as in *canadensis*), though some outer primaries may be narrowly edged with white. Whole top of head, nape, and sides of head to below eyes, olive-brown, the lateral borders of this patch blackish; an obsolete whitish patch on the nape. Central tail-feathers like the back, but with a long white spot, and their outer webs black at base; other tail-feathers blackish, with white marks, and often also tipped with the color of the back. Entire under parts ranging from muddy-white to smoky-brown or rich rusty, nearly or quite as intense as in *S. canadensis*; flanks and crissum shaded with a dull wash of the color of the back. Bill and feet dark plumbeous, the former paler at base below. Iris black.

Size of the last. Young: Differs much as the ♀ of *canadensis* does from the ♂, in having the top of the head like the back. U. S. from the Rocky Mts. to the Pacific, abundant, chiefly in pine woods; N. to Vancouver. Eggs 6–7, white, profusely speckled with reddish, 0.62 × 0.50.

5. Family CERTHIIDÆ: Creepers.

A very small, well-marked group, of about a dozen species, and four or five genera, which fall in two sections, commonly called subfamilies; one of these, *Tichodrominæ*, is represented by the well-known European Wall Creeper, *Tichodroma muraria*, and several (chiefly Australian) species of the genus *Climacteris;* while the genus *Certhia*, with five or six species or varieties, and certain allied genera (all but one Old World) constitute the

FIG. 145. — Common Brown Creeper, *Certhia familiaris*, nearly nat. size. (From Brehm.)

8. Subfamily CERTHIINÆ: Typical Creepers.

Our species may be known on sight, among North American *Oscines*, by its *rigid, acuminate* tail-feathers, like a woodpecker's. Besides: — bill about equal in length to head, extremely slender, sharp, and decurved; nostrils exposed; no rictal bristles; tarsus scutellate, shorter than 3d toe and claw, which is connate for the whole of the 1st joint with both 2d and 4th toe; lateral toes of unequal lengths, 1st toe shorter than its claw; claws all much curved and very sharp; wing 10-primaried, the 1st primary very short, not one-half the 2d, which is less than the 3d; point of wing formed by 3d, 4th, and 5th quills; tail rounded, equal to or longer than wing, of 12 stout, elastic, curved, acuminate feathers. Restless, active, little forest birds that make a living by picking bugs out of cracks in bark. In scrambling about they use the tail as woodpeckers do, and never hang head downwards, like the nuthatches. Lay numerous white, speckled eggs in knotholes; are not regularly migratory; have slight seasonal or sexual changes of plumage; are chiefly insectivorous, and not noted for musical ability.

18. **CERTHIA.** (Lat. *certhius*, a creeper. Fig. 146.) Characters as above. The stock-form of this genus varies according to locality. European varieties sometimes recognized are *C. costæ* and *C. britannica*. The N. Am. bird, which is inseparable from the European, has been called *C. rufa*, *fusca*, and *americana*, for Eastern specimens, *C. montana* for those from the Rocky Mt. region, and *C. occidentalis* for those from the Pacific coast region. The Mexican form, *C. mexicana*, differs more appreciably, as below given.

FIG. 146. — Head, foot, and tail-feather of *Certhia*, nat. size. (Ad nat. del. E. C.)

62. **C. familia'ris.** (Lat. *familiaris*, from *familia*, family; domestic, home-like. Fig. 145.) BROWN CREEPER. ♂ ♀: Upper parts dark brown, changing to rusty-brown on the rump, everywhere streaked with ashy-white. An obscure whitish superciliary stripe. Under parts dull whitish, sometimes tinged with rusty on the flanks and crissum. Wing-coverts and quills tipped with white, the inner secondaries also with white shaft-lines, which, with the tips, contrast with the blackish of their outer webs. Wings also twice crossed with white or tawny-white, the anterior bar broad and occupying both webs of the feathers, the other only on the outer webs near their ends. Tail grayish-brown, darker along the shaft and at the ends of the feathers, sometimes showing obsolete transverse bars. Bill blackish above, mostly flesh-colored or yellowish below; feet brown; iris dark brown. Length of ♂ 5.25–5.75; extent 7.50–8.00; wing 2.50; more or less; tail usually a little longer than the wing, sometimes not so, 2.50 to nearly 3.00; tarsus about 0.60; bill 0.65–0.75; ♀ averaging smaller than ♂. Temperate N. Am., in woodland, abundant, generally seen winding spirally up the trunks and larger branches of trees.

62a. **C. f. mexica'na.** (Lat. of Mexico.) MEXICAN CREEPER. Differs in lacking light tips of the primary coverts, and general richer coloration, the brown more rusty; rump bright chestnut; under parts grayish. Mexico, to S. W. border of the U. S. (Not in Check List, 1882; since ascertained to inhabit Arizona.)

6. Family TROGLODYTIDÆ: Wrens.

FIG. 147. — European Wren. (From Dixon.)

Embracing a number of forms assembled in considerable variety, and difficult to define with precision. Closely related to the last three families; known from these by non-acuminate tail-feathers and exposed nostrils. Very intimately resembling, in particular, the mocking group of thrushes — those with scutellate tarsi and not strictly spurious 1st primary; but all our wrens are *smaller* than any of the *Mimina*, and otherwise distinguished by less deeply cleft toes — as stated on p. 248; "the inner toe is united by half its basal joint to the middle toe, sometimes by the whole of this joint; and the second joint of the outer toe enters wholly or partially into this union, instead of the basal only." Nostrils narrowly or broadly oval, exposed, overhung by a scale; bill moderately or very slender, straight or slightly decurved, from half as long to about as long as the head, unnotched in all our genera; no evident rictal bristles; wings short, more or less rounded, with 10 primaries, the 1st short, but not strictly spurious; tail of variable length, much or little rounded, of broad or narrow feathers, often held over the back. Tarsi scutellate, sometimes behind as well as in front.

Excepting some Old World forms of doubtful affinity, and the species of *Anorthura* proper, the *Troglodytidæ* are confined to America; and if thus restricted are susceptible of better definition. About one hundred species or varieties are recognized, usually referred to about sixteen genera, most of which belong to tropical America, where the group reaches its maximum development, — over twenty species of *Campylorhynchus* being described, for instance. Of North American genera, *Campylorhynchus*, *Catherpes* and *Salpinctes* are confined to the West, and represent a section distinguished by the breadth of the tail-feathers, which widen toward the end. Species of all our other genera are common and familiar eastern birds, much alike in disposition, manners, and habits; the house wren typifies these. They are sprightly, fearless, and impudent little creatures, apt to show bad temper when they fancy themselves aggrieved by cats or people, or anything else that is big and unpleasant to them; they quarrel a good deal, and are particularly spiteful towards martins and swallows, whose homes they often invade and occupy. Their song is bright and hearty, and they are fond of their own music; when disturbed at it they make a great ado with noisy scolding. Part of them live in reedy swamps and marshes, where they hang astonishingly big globular nests, with a little hole in one side, on tufts of rushes, and lay six or eight dark colored eggs; the others nest anywhere, in shrubbery, knotholes, hollow stumps, and other odd nooks. Nearly all are migratory; one is stationary; one comes to us in the fall from the north, the rest in spring from the south. Insectivorous, and very prolific, laying several sets of eggs each season. Plainly colored, the browns being the usual colors; no red, blue, yellow, or green in any of our species.

Analysis of Subfamilies, Genera, and Species.

CAMPYLORHYNCHINÆ. Feet not strictly laminiplantar, the lateral plates divided, or not perfectly fused in one. Tail broad, fan-shaped, the individual feathers widening toward the end.
- Very large; length about 8 inches. Tarsus decidedly scutellate behind. Lateral toes of equal lengths.
  - Above streaked with white, below spotted with black . . . . . *Campylorhynchus*
    - Black and white bars of tail chiefly on outer webs of the feathers . . . . . *C. brunneicapillus* 63
    - Black and white bars of tail chiefly on both webs of the feathers . . . . . *C. affinis* 64
- Smaller, about 6.00 long. Tarsus scutellate behind. Lateral toes of unequal lengths *Salpinctes* (*S. obsoletus*) 65
- Smaller, about 5.50 long. Tarsus scarcely scutellate behind. Lateral toes of unequal lengths *Catherpes* (*C. mexicanus*) 66, 67

TROGLODYTINÆ. Feet strictly laminiplantar, as usual in Oscines. Tail thin, with narrow parallel-edged feathers. Wings and tail more or less completely barred cross-wise.
- Large. Upper parts uniform in color, without streaks or bars; rump with concealed white spots. Belly unmarked; a conspicuous superciliary stripe.
  - Tail shorter or not longer than the wing, all the feathers brown, distinctly barred *Thryothorus* (*T. ludovicianus*) 68, 69, 70
  - Tail decidedly longer than the wing, blackish, not fully barred on all the feathers *Thryothorus* (*T. bewicki*) 71, 72, 73
- Small. Upper parts not uniform, the back being more or less distinctly barred cross-wise; wings, tail, and flanks fully barred.
  - Tail about equal to the wing, the outstretched feet reaching scarcely or not beyond its end *Troglodytes* (*T. domesticus*) 74, 75
  - Tail decidedly shorter than the wing, the outstretched feet reaching far beyond its end *Anorthura* (*A. troglodytes*) 76, 77, 78
- Small. Upper parts not uniform, the back being streaked length-wise; flanks scarcely or not barred.
  - Bill about ⅔ as long as head; crown plain; streaks of back confined to interscapular region *Telmatodytes* (*T. palustris*) 79, 80
  - Bill scarcely or not ½ as long as head; crown streaked, like the whole back *Cistothorus* (*C. stellaris*) 81

9. Subfamily CAMPYLORHYNCHINÆ: Fan-tailed Wrens.

For characters of this group and analysis of its genera, see above.

19. **CAMPYLORHYNCHUS.** (Gr. καμπύλος, *kampulos*, bent; ῥύγχος, *rhugchos*, beak.) CACTUS WRENS. Of largest size in this family; length about 8.00 inches. Tarsus *scutellate behind*. Lateral toes of equal lengths. Wings and tail of about equal lengths. Tail broad,

with wide feathers. Tarsus a little longer than the middle toe and claw. Upper parts with sharp white streaks on a brown ground; under parts boldly spotted with black on a white ground; tail-feathers barred with black and white.

63. C. brunneicapil'lus. (Lat. *brunneus*, brown; *capillus*, hair.) BROWN-HEADED CACTUS WREN. ♂, adult: Back grayish-brown, marked with black and white, each feather having a central white field several times indented with black. Whole crown of head and nape rich dark wood-brown, immaculate. A long white superciliary stripe from nostril to nape. Beneath, nearly pure white anteriorly, gradually shading behind into decided cinnamon-brown — the throat and fore part of the breast marked with large, crowded, rounded black spots, the rest of the under parts with small, sparse, oval or linear black spots, again enlarging on the crissum. Wings darker and more fuscous-brown than the back; all the quills with a series of numerous white or whitish indentations along the edge of both webs. Central tail-feathers like the wings, with numerous more or less incomplete blackish bars; other tail-feathers blackish, the outer with several broad white bars on both webs; the rest with usually only a single complete white bar near the end. Bill dark plumbeous, paler below; iris orange. Length near 8.00; wing 3.50; tail rather longer; bill 0.80; tarsus 1.00; middle toe and claw 0.90. ♀, adult: Quite like the ♂, but the spots on the throat and breast rather smaller, therefore less crowded, and less strongly contrasting with the sparse speckling of the rest of the under parts. Young: Similar to the adult on the upper parts, but the throat whitish with little speckling; scarcely any spots on the rest of the under parts, which are, however, as decidedly cinnamon as those of the adults. Southwestern U. S., — Texas, New Mexico, Arizona, southern Utah and Nevada, and portions of California; common in cactus and chaparral, building a large purse-shaped nest in bushes; eggs about 6, 1.00 × 0.68, white, uniformly and minutely dotted with salmon-color. (If not *C. brunneicapillus* Lafr., this will stand as **C. couesi** Sharpe, Cat. Br. Mus., vi, 1882, p. 196.)

64. C. affi'nis. (Lat. *affinis*, affined, allied; *ad*, and *finis*.) ST. LUCAS CACTUS WREN. Similar to the last. Cap reddish-brown, lighter instead of darker than the back. Markings of back very conspicuous, in strong streaks of black and white, these two colors bordering each other with little or no indentation. Under parts nearly white, the black spots, though conspicuous, not enlarged and crowded on the breast, but more regularly distributed. All the lateral tail-feathers, instead of only the outer ones, crossed on both webs with numerous complete white bars. The variations with sex and age correspond with those of *C. brunneicapillus*. Lower California. Nest and eggs as before. (According to Sharpe, *l. c.*, this is **C. brunneicapillus** Lafr.)

20. SALPINC'TES. (Gr. σαλπιγκτής, *salpigktes*, a trumpeter.) ROCK WRENS. Bill about as long as head, slender, compressed, straight at base, then slightly decurved, acute at tip, faintly notched. Nostrils conspicuous, scaled, in a large fossa. Wing longer than tail; exposed portion of 1st primary about half as long as 2d, which is decidedly shorter than 3d. Tail rounded, of 12 broad plane feathers, with rounded or subtruncate ends. Feet small and weak; tarsus longer than middle toe, *scutellate posteriorly*. Hind toe and claw shorter than middle one; lateral toes of unequal lengths, the outer longest, both very short, the tips of their claws falling short of base of middle claw. Only one species known.

FIG. 148. — Rock Wren, nat. size. (Ad nat. del. E. C.)

65. S. obsole'tus. (Lat. *obsoletus*, unaccustomed; *ob*, and *soleo*, I am wont; hence obsolete, effaced, the coloration being dull and diffuse. Fig. 148.) ROCK WREN. ♂ ♀, adult: Upper parts pale brownish-gray, minutely dotted with blackish and whitish points together, and usually

showing obsolete wavy bars of dusky. Rump cinnamon-brown; a whitish superciliary line. Beneath, soiled white, shading behind into pale cinnamon, the throat and breast obsoletely streaked, and the under tail-coverts barred, with dusky. Quills of the wings rather darker than the back, with similar markings on the outer webs. Middle tail-feathers like the back, with many dark bars of equal width with the lighter ones; lateral tail-feathers similarly marked on the outer webs, plain on the inner webs, with a broad subterminal black bar on both webs, and cinnamon-brown tips, the latter usually marbled with dusky; outer feathers with several blackish and cinnamon bars on both webs. Bill and feet dark horn color, the former paler at base below. Length 5.50–6.00; wing 2.60–2.80; tail 2.20–2.40; bill 0.66–0.75; tarsus 0.75–0.80. Most of the markings blended and diffuse. Shade of upper parts variable, from dull grayish to a more plumbeous shade, often with a faint pinkish tinge. Specimens in worn and faded plumage may fail to show the peculiar dotting with black and whitish; but in these the crosswise dusky undulation, as well as the streaks on the breast, are commonly more distinct than in fresher-feathered examples. The rufous tinge of the under parts is very variable in shade; that of the rump, however, being always well marked. Western U. S., E. to Iowa; common, haunting rocky places, where it is conspicuous by its restlessness and loud notes; nest of any rubbish in a rocky nook; eggs numerous, 5–8, of crystalline whiteness, sparsely sprinkled with reddish-brown dots, 0.75 × 0.62.

21. **CATHERPES.** (Gr. καθερπής, *katherpes*, a creeper; κατά, *kata*, down, ἕρπω, *herpo*, I creep.) Cañon Wrens. Bill singularly attenuate, about as long as head, nearly straight in all its outlines, with such direction of its axis that the bill as a whole appears continuous with the line of the forehead. Tarsus not longer than middle toe and claw, with tendency to subdivision of the lateral tarsal plate. Lateral toes of unequal lengths, the outer longest. Wings and tail as in *Salpinctes*, and general features, even to system of coloration, much the same as in that genus. One known species, with several varieties.

66. **C. mexicanus.** Mexican Cañon Wren. Similar to the form next described: much darker colored both above and below, with sharper contrast of the white throat; the white speckling mostly restricted to the back and wings; the black tail-bars broader and more regular, and the light markings of the wings mere indentations instead of complete bars. Bill straight, more abruptly decurved at extreme tip. Feet stouter, dark brown. Size greater; length about 6.00; wing 2.80; tail 2.40; bill nearly 1.00 long, only about 0.12 deep at base. Specimens vary much in sharpness and extensiveness of the speckling of the upper parts. In best-marked cases, the spots quite white, almost lengthened into streaks, each one completely set in black; other examples, small, sparse and restricted, these specimens also showing wavy transverse in bars of blackish. Mexico, to Texan border.

67. **C. m. conspersus.** (Lat. *conspersus*, speckled.) Speckled Cañon Wren. ♂ ♀, adult: Upper parts brown, paler and grayer anteriorly, behind shading insensibly into rich rufous, everywhere dotted with small dusky and whitish spots. Tail clear cinnamon-brown, crossed with numerous very narrow and mostly zigzag black bars. Wing-quills dark brown, the outer webs of the primaries and both webs of the inner secondaries barred with the color of the back. Chin, throat, and fore breast, with lower half of the side of the head and neck, pure white, shading behind through ochraceous-brown into rich deep ferruginous, and posteriorly obsoletely waved with dusky and whitish. Bill slate-colored, paler and more livid below; feet black; iris brown. Length about 5.50; extent 7.50; wing 2.30; tail 2.12; tarsus 0.60; bill 0.80. Throughout New Mexico and Arizona, and portions of Texas, Colorado, Utah, Nevada, and California; N. to at least 40°. A remarkable bird, famous for its ringing notes, inhabiting cañons and other rocky places. Nesting and eggs like those of the rock wren; eggs 5 or more, 0.75 × 0.55, crystal white, fairly sprinkled and blotched with reddish-brown.

67a. **C. m. punctulatus.** (Lat. *punctulatus*, dotted.) Dotted Cañon Wren. Smaller than either of the foregoing: length about 5.00; wing 2.10; tail 1.90; bill 0.75. Coloration inter-

mediate; upper parts most like those of *C. conspersus*, and wings completely barred as in that species; but under parts posteriorly dusky ferruginous (dark mahogany color), and tail-bars broad, firm, and regular, as in *mexicanus* proper. Coast region of California. The type specimen, the only one I have seen, for some years in my cabinet and now No. 82,715, Mus. S. I., seems to be recognizably distinct; but all the forms of the genus intergrade. (Not in Check List, 1882; since described by Ridgway, Pr. Nat. Mus., v., 1882, p. 343.)

10. Subfamily TROGLODYTINÆ: True Wrens.

See characters and analysis of this group on p. 274.

22. **THRYOTHO'RUS.** (Gr. *θρύον, thruon*, a reed, and *θοῦρος, thouros*, leaping.) REED WRENS. Of largest size in this subfamily; length 5.50–6.00. Back uniform in color, without streaks or bars; wings and tail more or less barred crosswise; belly unmarked; a long superciliary stripe; rump with concealed white spots. Eggs colored.

Tail not longer than wings, like back in color, and barred, in *Thryothorus* proper . . . . . Nos. 68, 69, 70
Tail longer than wings, blackish, not fully barred, in *Thryomanes* 71, 72, 73

68. **T. ludovicia'nus.** (Lat. *Ludovicianus*, Louisiana; of Ludovicus, Louis XIV., of France. Fig. 149.) GREAT CAROLINA WREN. Upper parts uniform reddish-brown, brightest on the rump, where are concealed whitish spots; a long whitish superciliary line, usually bordered with dusky streaks; upper surfaces of wings and tail like back, barred with dusky, the outer edges of the primaries and lateral tail-feathers showing whitish spots. Below, rusty or muddy whitish, clearest anteriorly, deepening behind, the under tail-coverts reddish-brown barred with blackish. Wing-coverts usually with dusky and whitish tips. Feet livid flesh-colored. Length 6.00; extent nearly 7.50; wing 2.40; tail 2.25; bill 0.65; tarsus 0.75. Eastern U. S., southerly; N. regularly to the Middle States, rarely to Massachusetts; resident as far north at least as Washington. A common and well-known inhabitant of shrubbery, with a loud ringing song; shy and secretive. Nest in any nook about out-buildings, or in shrubbery, when in the latter usually roofed over, of the most miscellaneous materials; eggs 6–7, white, profusely speckled and blotched with shades of reddish, brown, and purplish; 0.72 × 0.60.

FIG. 149. — Great Carolina Wren, reduced. (From Nuttall, after Audubon.)

69. **T. l. miamien'sis.** (Of the Miami River, Florida.) FLORIDAN WREN. Similar: larger, stouter, and more deeply-colored, especially below, where nearly uniform rusty-brown. Wing 2.75; tail 2.60; bill 0.90; tarsus 0.95. Florida; a local race.

70. **T. l. berlan'dieri.** (To Dr. Louis Berlandier.) TEXAN WREN. Similar: smaller; length 5.25; wing 2.25; tail 2.12. Coloration darker than in typical *ludovicianus*, especially below; flanks as well as crissum barred with dusky; tail-bars broken up into irregular nebulation. Valley of the Rio Grande; a local race.

71. **T. be'wicki.** (To Thomas Bewick.) BEWICK'S WREN. Above, dark grayish-brown; below, ashy-white, with a brownish wash on the flanks. Rump with concealed whitish spots. A long whitish superciliary stripe from nostrils to nape. Under tail-coverts dark-barred; two middle tail-feathers like back, with numerous fine black bars; others black with whitish

markings on the outer webs and tips. Length about 5.50; extent 6.75; wing 2.00–2.12; tail 2.35; bill 0.50; tarsus 0.75. Eastern U. S., southerly, N. to the Middle States and Minnesota. Not very common in the Atlantic States, but so abundant as to replace the house wren in some parts of the interior. Nest in holes in trees, stumps, fences, etc.; eggs white, finely dotted and spotted, resembling those of *Cathcrpes* or *Salpinctes*.

72. **T. b. leucogas'ter.** (Gr. λευκός, *leukos*, white; γαστήρ, *gaster*, belly.) WHITE-BELLIED WREN. Above, uniform clear ashy-brown; below, clear ashy-white; pure white on the middle parts. A long, strong, white superciliary stripe; auriculars speckled with white. Concealed white spots on the rump. Quills of the wings fuscous, the inner feathers very obsoletely waved with the color of the back. Two middle tail-feathers closely barred with pure dark ash and black; others black, with irregular white or ashy-white tips, the outer web of the exterior feather barred with white. Length 5.50–5.75 inches; extent 6.75; wing 2.00–2.33; tail 2.25–2.50; bill 0.50; tarsus 0.75. Southwestern U. S.; a well-marked geographical race.

73. **T. b. spilu'rus?** (Gr. σπίλος, *spilos*, spotted; οὐρα, *oura*, tail.) SPECKLED-TAILED WREN. Similar to No. 71, and scarcely distinguishable; bill said to be longer, 0.60. Pacific Coast.

23. **TROGLO'DYTES.** (Gr. τρωγλοδύτης, *troglodutes*, a cave-dweller.) HOUSE WRENS. Of small size; no decided superciliary line. Upper parts not uniform in color, the back more or less distinctly barred crosswise; wings, tail, and flanks fully barred crosswise; tail about equal to wing in length, the outstretched feet scarcely or not reaching beyond its end. Eggs colored.

74. **T. domes'ticus.** (Lat. *domesticus*, domestic; *domus*, a house.) EASTERN HOUSE WREN. Brown, brighter behind; below rusty-brown, or grayish-brown, or even grayish-white; everywhere waved with darker shade, very plainly on wings, tail, flanks, and under tail-coverts; breast apt to be darker than either throat or belly; bill shorter than head, about 0.50; wings and tail nearly equal, about 2.00, but ranging from 1.90 to 2.10; total length 4.50–5.25, averaging about 4.90; extent about 6.75. Exposed portion of 1st primary about one-half as long as longest primary. Eastern U. S., N. to Canada, W. to Dakota; very abundant anywhere in shrubbery, gardens, and about dwellings, where its active, sprightly, and fearless demeanor, together with its hearty trilling song, bring it into friendly notoriety. Nest of any trash in a hole of a building, fence, tree, or stump; eggs 6–9, 0.65 × 0.55, profusely and uniformly studded with minute points of brown, often rendering an almost uniform color; two or three broods each season. Resident in the South, migratory farther north.

75. **T. d. park'mani.** (To Dr. Geo. Parkman, of Boston.) WESTERN HOUSE WREN. Brown above, little brighter on rump, nearly everywhere waved with dusky, strongest on wings and tail, but usually appreciable on the whole back. Below brownish-white, nearly white on belly, obscurely variegated with darker markings, which, on the flanks and crissum, become stronger bars, alternating with brown and whitish ones. Bill blackish above, pale below; feet brown. Length 5.00–5.25; extent 6.75; wing and tail about 2.10. Exposed portion of 1st primary about one-half as long as 2d primary. Western U. S., from the Plains to the Pacific, abundant, there replacing *T. domesticus*, to which it is so similar; but on an average paler and grayer, with rather longer wings and tail.

24. **ANORTHU'RA.** (Gr. ἀν, *an*, signifying negation; ὀρθός, *orthos*, straight; οὐρα, *oura*, tail. Fig. 147.) WINTER WRENS. Like *Troglodytes* proper, but tail decidedly shorter than wings, the outstretched feet reaching far beyond its end. Eggs colored.

76. **A. troglo'dytes hiema'lis.** (Lat. *hiemalis*, wintry; *hiems*, winter. Fig. 150.) WINTER WREN. Above brown, darker before, brighter behind, most of back, together with tail and inner wing-quills, banded with dusky, the markings obsolete on the back, where usually accompanied by whitish specks, strongest on the wings and tail. Outer webs of several primaries regularly barred with brownish-white, in marked contrast with the other bars of the wings. An inconspicuous whitish superciliary line. Below brownish, paler or whitish anteriorly, the belly, flanks, and crissum heavily waved with dusky and whitish bars. Bill slender, straight, decidedly

shorter than the head. Tail much shorter than the wings. Length 3.90–4.10; extent 6.00–6.50; wing 1.75; tail 1.25; bill 0.40; tarsus, middle toe, and claw together, about 1.12. N. Am. at large, common, migratory, breeding from New England and corresponding latitudes northward, wintering in the U. S., the strict representative of the European wren. Nest of twigs, moss, lichens, hair, feathers, etc., usually in a stump or log close to the ground; eggs 5–8, 0.65 × 0.48, pure white, minutely dotted with reddish-brown and purplish. A sly, secretive little bird, less often seen than other wrens no less common; voice strong and highly musical.

Fig. 150. — Winter Wren, little reduced. (Baird's figure of *A. alascensis.*)

77. **A. t. paci'ficus?** (Lat. *pacificus*, pacific, peace-making; *pax* and *facio;* alluding to "the stilly sea.") Western Winter Wren. Like the last; darker, in lack of the whitish specks of the upper parts, and whitish bars on outer webs of the primaries; but very slightly distinguished. Pacific Coast region.

78. **A. t. alascen'sis.** (Of Alaska.) Alaskan Winter Wren. Like the common species in form and coloration; larger; size of a house wren; wing 2.00–2.20; tail 1.50; tarsus 0.75; tarsus, middle toe, and claw together 1.40; bill 0.65. Culmen, gape, and gonys almost perfectly straight, latter slightly ascending. Aleutian and Pribylov Islands, Alaska. Well distinguished from the common form, and nearer the Japanese *A. fumigatus.*

25. **TELMATO'DYTES.** (Gr. τέλμα, *telma*, a swamp; δύτης, *dutes*, an inhabitant.) Marsh Wrens. Small. Upper parts not uniform; back streaked lengthwise with white in a black patch; flanks scarcely or not barred; crown plain; bill about two-thirds as long as head. Eggs dark.

79. **T. palus'tris.** (Lat. *palustris*, marshy; *palus*, a marsh. Fig. 151.) Long-billed Marsh Wren. Above clear brown, unbarred, the middle of the back with a large black patch sharply streaked with white (these white stripes sometimes deficient). Crown of head usually darker than the back, often quite blackish, and continuous with the black interscapular patch. A dull white superciliary line. Wings fuscous, the inner secondaries blackish on the outer webs, often barred or indented with light brown. Tail evenly barred with fuscous and the color of the back. Under parts white, usually quite pure on the belly and middle line of the breast and throat, but much shaded with brown on the sides, flanks, and crissum. Bill blackish above, pale below; feet brown. Length about 5.00; extent 6.50; wing 1.75–2.00; tail about the same; bill 0.50 or more; tarsus 0.66–0.75. Temperate N. Am.; Greenland. Breeds throughout its range, and winters in the Southern States; an abundant bird, colonizing reedy swamps and marshes in large numbers, its great globular nests of plaited rushes, with a hole in the side, being affixed to the swaying herbage; eggs 6–10, 0.58 × 0.45, very dark-colored, being so thickly dotted with chocolate-brown as to appear almost uniformly of this color.

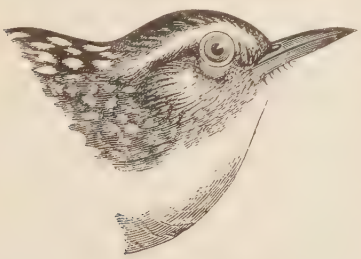

Fig. 151. — Long-billed Marsh Wren, nat. size. (Ad nat. del. E. C.)

80. **T. p. paludi'cola?** (Lat. *paludicola*, a marsh-inhabiter; *palus* and *colo*, I cultivate.) Tulé Marsh Wren. Scarcely recognizable as distinct; bill said to be shorter, and tail and its coverts more distinctly barred. Pacific Coast.

78. CISTOTHO'RUS. (Gr. κίστος, *kistos*, a shrub; θοῦρος, *thouros*, leaping.) MARSH WRENS. Like *Telmatodytes;* whole back and crown streaked with white. Bill scarcely or not one-half as long as head. Eggs white.

81. C. stella'ris. (Lat. *stellaris*, starry; i. e., speckled. Fig. 152.) SHORT-BILLED MARSH WREN. Upper parts brown, the crown and most of the back blackish, streaked with white. Below, whitish, shaded with clear brown across the breast and along the sides, and especially on the flanks and crissum, the latter more or less indistinctly barred with dusky (often inappreciable). A whitish line over the eye. Wings and tail marked as in the last species. Upper tail-coverts decidedly barred. Bill blackish above, whitish below, extremely small, scarcely half as long as the head; feet brown. Length 4.50; extent 5.75–6.00; wing and tail each about 1.75; bill 0.35–0.40; tarsus, middle toe, and claw together, about 1.12. The streaking of the head and that of the back are usually separated by a plain nuchal interval; but these are as often run together, the whole bird above being streaked with whitish and blackish upon a brown ground. The wings, tail, and entire under parts are much like those of *T. palustris*, from which the species is distinguished by the markings of the upper parts and extremely short bill. Chiefly Eastern U. S. and adjoining British Provinces; W. to Utah. Migratory; winters in the Southern States. Frequents marshy places like *T. palustris*, but is not common. Nesting different, and eggs white.

FIG. 152. — Short-billed Marsh Wren, nat. size. (Ad nat. del. E. C.)

7. Family ALAUDIDÆ: Larks.

A rather small group, well defined by the character of the feet, in adaptation to terrestrial life. The subcylindrical tarsi are scutellate and blunt behind as in front, with a deep groove along the inner side, and a slight one, or none, on the outer face. That is to say, there is an anomalous structure of the tarsal envelope; the tarsus being covered with two series of scutella, one lapping around in front, the other around behind, the two meeting along a groove on the inner face of the tarsus, which is consequently blunt behind as well as in front. There is a simple suture of the two series of plates on the outer face of the tarsus; the individual plates of each series alternate. Other characters (shared by some *Motacillidæ*) are the very long, straight, hind claw, which equals or exceeds its digit in length; the long, pointed wings, with the 1st primary spurious or apparently wanting, and the inner secondaries ("tertiaries") lengthened and flowing. The nostrils are usually concealed by dense tufts of antrorse feathers. The shape of the bill is not diagnostic, being sometimes short, stout and conic, much as in some *Fringillidæ*, while in other cases it is slenderer, and more like that of insectivorous *Passeres*. The family is composed, nominally, of a hundred species; with the exception of one genus and two or three species or varieties, it is confined to the Old World. Its systematic position is open to question; some place it at the end of the Oscine series, or remove it from *Oscines* altogether, on account of the peculiarities of the podotheca; authors generally place it near the *Fringillidæ*, from the resemblance of the bill of some species to that of some finches; but it has many relationships with *Motacillidæ*, and, in the arrangement of this work, I find no better place for it than here, though it has no special affinity with the preceding families. Moreover, the fact that it appears to have indifferently 9 or 10 primaries may indicate a natural position between the sets of families in which number of primaries is among the diagnostic features. The musical apparatus is certainly well developed, as testified by the eminent vocal powers of the celebrated sky-lark of Europe. The unpractised reader must be careful not to confound the larks proper with certain birds loosely called "larks"; thus the tit*larks*, or pipits, though sharing the lengthened, straightened hind claw and elongated inner wing-quills of

Alaudidæ, belong to an entirely different family, the *Motacillidæ;* while the American field-*lark* is one of the *Icteridæ*, much further removed.

According to shape of bill, structure of nostrils, and apparent number of primaries, the family may be divided into two subfamilies, the *Alaudinæ*, typified by the celebrated sky-lark of Europe, and the *Calandritinæ*, of which the well-known horned lark is a typical representative. Both of these occur in North America; the *Alauda*, however, only as a straggler from Europe.

FIG. 153. — Shore Lark, much reduced. (From Tenney, after Baird.)

CALANDRITINÆ, without evident spurious 1st primary, the primaries apparently only 9.

ALAUDINÆ, with spurious 1st primary, the primaries therefore evidently 10.

11. Subfamily CALANDRITINÆ: Shore Larks.

Represented in America by the single genus *Eremophila*, of which there are nominally ten, really four or five species, one of which occurs in North America.

27. **EREMO'PHILA.** (Gr. ἐρῆμος, *eremos*, a desert; φιλέω, *phileo*, I love.) HORNED LARKS. Primaries apparently only 9 (no obvious spurious 1st primary). Point of the wing formed by the first 3 developed primaries. Inner secondaries elongated. Tail of medium length, nearly even, the middle pair of feathers different in shape and color from the rest. Bill compressed-conoid, acute, shorter than head. Nostrils completely concealed by dense tufts of antrorse feathers. Head not crested, but a peculiar tuft of feathers over each ear, somewhat like the so-called "horns" of some owls. Feet of ordinary alaudine characters, as already given. Coloration peculiar in the presence of yellowish tints and strong black bars on the head and breast. The birds of this genus frequent open places, are strictly terrestrial in habits, and never hop when on the ground, like most *Passeres;* they are migratory in most localities, and gregarious, except when breeding; nest on the ground, and lay 4–5 speckled eggs; sing sweetly in the spring time.

82. **E. alpes'tris.** (Lat. *alpestris*, alpine. Figs. 153, 154.) HORNED OR SHORE LARK. ♂ ♀, adult, in breeding plumage: Upper parts in general pinkish-brown, this pinkish or vinaceous or liliaceous tint brightest on the nape, lesser wing-coverts, and tail-coverts, the rest of the upper parts being duller and more grayish-brown, boldly variegated with dark brown streaks; middle pair of tail-feathers and several of the inner secondaries rufous-brown, with darker centres. Under parts, from the breast backward, white; the sides strongly washed with the color of the upper parts, and mottling of same across the lower part of the breast. A large, distinct, shield-shaped black area on the breast. Tail-feathers, except the middle pair, black, the outermost edged with whitish. Wing-quills, except the innermost, plain fuscous, the outer web of the 1st primary whitish. Lesser wing-coverts usually tipped with grayish-white. Top of head like nape; bar across front of vertex, thence extended along sides of crown, and produced into a tuft or "horn," black; front and line over eye, also somewhat produced to form part of the tuft, white or yellowish; a broad bar from nostrils along the lores, thence curving below the eye and widening as it descends in front of the auriculars, black; rest of the sides of the head

FIG. 154. — Shore Lark, nat. size. (Ad nat. del. E. C.)

and whole throat white or sulphury-yellow. Bill plumbeous-blackish, bluish-plumbeous at base below (sometimes there yellowish); feet and claws black; iris brown. Length of ♂, 7.00–7.50; extent 13.00–14.00; wing 4.25–4.50; tail 2.75–3.00; bill, from extreme base of culmen, 0.40–0.50; tarsus 0.88–0.90; middle toe and claw rather less; hind claw about 0.50, usually longer than its digit, but very variable. ♀ commonly smaller than the ♂; length 6.75–7.25; extent 12.75–13.25; wing about 4.00, etc. ♂ ♀, adult, in winter: As usually seen in most of the United States in the fall, winter, and early spring, differ from the above in more sordid coloration of the upper parts, which may be simply grayish-brown, heavily streaked with dusky, even on the crown, with little or none of the "pinkish" tints; and in lack or restriction of the black markings of the head and breast, or their being veiled with whitish tips of the individual feathers; nevertheless, the sulphury tinge of the white parts about the head is usually very conspicuous. Fledglings have the upper parts dusky, mixed with some yellowish-brown, and sprinkled all over with whitish or light tawny dots, each feather having a terminal speck. Most of the wing- and tail-feathers have rusty, tawny, or whitish edging and tipping. The under parts are white, mottled with the colors of the upper parts along the sides and across the back; no traces of definite black markings about the head and breast, nor any yellow tinge. Bill and feet pale or yellowish. This peculiar speckled stage is of brief duration; with an early autumnal change, a dress, little if at all different from that of the adults in winter, is acquired. Nesting begins very early in April, or even in March, sometimes before the snow is gone, and frequently other broods are reared through the summer; nest of grasses, etc., sunken in the ground: eggs very variable in tone, but always profusely and heavily marked with brownish-gray or dark stone-gray upon a grayish or greenish-white ground; in some cases the whole surface nearly uniform. Northern hemisphere at large; in America, chiefly northern and eastern parts, breeding from the Northern States northward, common in flocks in the U. S. in winter; chiefly replaced in the West by the following varieties.

83. E. a. leucolæ'ma. (Gr. λευκός, *leukos*, white; λαιμός, *laimos*, throat.) WESTERN SHORE LARK. Size of the foregoing. General coloration extremely pale — brownish-gray, the peculiar pinkish tint of certain parts sharing the general pallor. Black markings on head and breast much restricted in extent, and white surroundings correspondingly increased — thus, the black post-frontal bar scarcely or not broader than the white of the forehead. No yellow about head, excepting usually a slight tinge on the chin. Changes of plumage parallel with those already given; even the nestlings show the same decided pallor. Prairies of Western U. S., breeding everywhere north of about 40°; very abundant.

84. E. a. chrysolæ'ma. (Gr. χρύσεος, *chruseos*, golden; λαιμός, *laimos*, throat.) SOUTH-WESTERN SHORE LARK. Smaller than the foregoing: ♂ with the wing scarcely or not 4.00, and other dimensions to correspond; a very small specimen, probably ♀, has the wing only 3.50; in another, marked ♂, it is 3.75. The "pinkish" tinge intensified into cinnamon-brown, and pervading nearly all the upper parts; yellow of head intensified; black markings very heavy, — the black on the crown widened to occupy more than half the cap, reducing the white frontlet to a mere trace. Southwestern U. S. and Mexico, breeding mostly south of 40°; abundant.

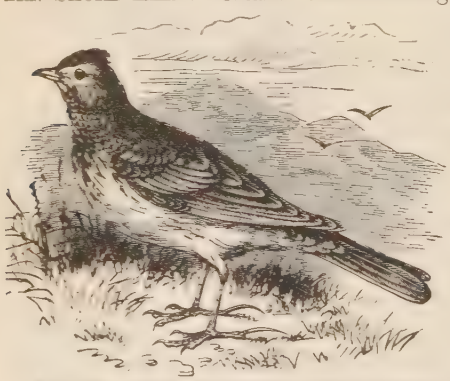

FIG. 155. — Sky-Lark, reduced. (From Dixon.

12. Subfamily ALAUDINÆ: Sky-Larks.

Represented in America by one species, a straggler from the Old World. Fig. 155.

28. **ALAU'DA.** (Lat. *alauda*, a lark; supposed Celtic *al*, high, and *aud*, song.) SKY-LARKS.

Primaries 10, the spurious 1st primary minute but evident. Head subcrested, but without lateral ear-tufts. Wings long, pointed, the tip formed by the first 3 developed primaries; inner secondaries long and flowing. Tail emarginate, little more than half as long as wing. Tarsus equal to middle toe and claw. Lateral toes of unequal lengths. Sexes alike. Nest on the ground. Eggs 4–5, thickly speckled.

85. A. arven'sis. (Lat. *arvensis*, relating to arable land; *arvum*, a ploughed field.) SKY LARK. Upper parts grayish-brown, the feathers with darker centres; under parts whitish, tinged with buff across breast and along sides, and there streaked with dusky; a pale superciliary line; wings with much whitish edging; outer tail-feather mostly white, the next one or two with white borders. Length of ♂ 7.50; extent 14.75; wing about 4.00; tail 2.50; bill 0.50; tarsus or middle toe and claw 1.00; hind toe 0.45, its claw up to nearly 1.00. ♀ smaller. This celebrated bird, whose music so often inspires the poet, occurs as a straggler from Europe in Greenland, and also, it is said, in Bermuda and Alaska. It has also been imported and turned out in this country, where it may perhaps become naturalized.

8. Family MOTACILLIDÆ · Wagtails and Pipits.

FIG. 156. — Upper, White Wagtail; lower, Yellow Wagtail. (From Dixon.)

Bill shorter than the head, very slender, straight, acute, notched at tip. Nostrils not concealed by feathers, which however reach into the nasal fossæ. Rictus not notably bristled. Primaries 9, of which the 1st is about as long as the 2d, and the first 3, 4, or 5, form the point; inner secondaries enlarged, the longest one nearly or quite equalling the primaries in the closed wing. Tail lengthened, averaging about equal to the wing. Feet long and slender; tarsus scutellate, usually longer than the middle toe and claw; inner toe cleft to the very base, but basal joint of outer toe soldered with the middle one; hind toe bearing a long and little curved claw (except in *Motacilla* proper). A pretty well-defined group of one hundred, chiefly Old World, species, which may be termed terrestrial Sylvias, all living mostly on the ground, where they run with facility, never hopping like most *Oscines*. They are usually gregarious; are insectivorous and migratory. They have gained their name from the characteristic habit of moving the tail with a peculiar see-saw motion, as if they were using it to balance themselves upon unsteady footing. They may be distinguished from all the foregoing birds, except *Alaudidæ*, by having only 9 primaries; from all the following *Oscines*, by having long flowing inner secondaries; and from *Alaudidæ*, with which they agree in this respect, as well as in usually having a lengthened, straightish hind claw, by having the tarsal envelope as in *Oscines* generally, slender bill, and exposed nostrils. Two subfamilies are generally recognized, though the distinctions are scarcely more than generic.

Analysis of Subfamilies and Genera.

MOTACILLINÆ. Point of wing formed by first 3 primaries. Tail longer or not obviously shorter than wings, with narrow tapering feathers. Hind claw variable in length and curvature. Coloration black and white, or yellow and greenish.

Tail decidedly longer than wings, doubly emarginate. Hind claw of ordinary length and curvature. Colors black, ashy, and white, in masses . . . . . *Motacilla* 29

Tail, if anything, shorter than wings, nearly even. Hind claw lengthened and straightened. Colors yellow and green, in masses . . . . . *Budytes* 30

ANTHINÆ. Point of wing formed by first 4 or 5 primaries. Tail decidedly shorter than wings, its feathers not tapering. Hind claw lengthened and straightened. Coloration brownish, the under parts streaked, upper usually also variegated.

Tarsus not shorter (rather longer) than hind toe and claw. Tail moderately shorter than wing, the outstretched feet not reaching beyond its end . . . . . *Anthus* 31

Tarsus shorter than hind toe and claw. Tail only about two-thirds as long as wing, the outstretched feet reaching beyond its end . . . . . *Neocorys* 32

13. Subfamily MOTACILLINÆ: Wagtails.

Represented in America by two species; in the Old World by nearly fifty species or varieties, chiefly belonging to the genus *Motacilla* and its subdivisions or immediate allies, of which *Budytes* is one, forming a perfect connecting link between *Motacilla* proper and the *Anthinæ*.

29. **MOTACIL'LA.** (Lat. *mota-cilla*, wag-tail; name of some small bird.) WHITE WAGTAILS. Tail much longer than wings, of 12 narrow, weak, tapering or almost linear feathers. First 3 primaries about equal and longest; longest secondary (when full grown) about reaching their ends when the wing is closed; these flowing secondaries narrow and tapering. Tarsi long and slender; lateral toes of about equal lengths; hind claw not particularly lengthened or straightened; with its digit much shorter than the tarsus. Form remarkably lithe and slender; coloration black, ashy, and white, in large masses.

86. **M. al'ba.** (Lat. *alba*, white. Fig. 156.) WHITE WAGTAIL. ♂, in summer: Head black, with a broad mask of white across forehead and along sides; the black extending on the fore-breast; wings blackish, with much white edging and tipping of the quills and greater coverts; tail black, the two lateral feathers on each side mostly white; back and sides ashy; lower parts mostly white; bill and feet black. In winter the black more restricted, that on the fore breast forming a crescent spot. ♀ similar, the black still more restricted, in part replaced by gray. Young, gray above, grayish-white below, with a gray or blackish crescent on the fore neck. Length about 7.25; wing 3.25; tail 3.75; tarsus 0.90; hind toe and claw 0.60; bill 0.50. A species of wide distribution in Europe and Asia, occasional in Greenland.

86a. **M. ocula'ris.** (Lat. *ocularis*, ocular.) SIBERIAN WAGTAIL. Larger, and with a black eye-stripe in the white mask. Occurs at Plover Bay, East Siberia, and may be expected across Behring's Straits. (Not in the Check List, 1882; since found in California.)

30. **BU'DYTES.** (Gr. *βουδύτης*, *boudutes*, some small bird.) YELLOW WAGTAIL. Characters of *Motacilla;* tail shorter, not exceeding the wing in length; hind claw lengthened and straightish; hind toe and claw nearly as long as the tarsus. Coloration chiefly yellow and greenish.

87. **B. fla'vus?** (Lat. *flavus*, yellow. Figs. 157, 156.) YELLOW WAGTAIL. BLUE-HEADED QUAKE-TAIL. Adult: Above, yellowish-green; below, rich yellow, shaded with greenish on the sides, and bleaching on the chin. Top and sides of head bluish-gray, enclosing a long white superciliary stripe; a dusky stripe from corner of mouth through eye to ear-coverts. Quills of the wing dusky, the lesser coverts edged with the color of the back; median and greater coverts showing whitish wing-bars, and inner secondaries edged with the same. Tail dusky, the middle feathers edged with the color of the back; the outer two on each side

FIG. 157. — Yellow Wagtail, nearly nat. size. (After Baird.)

mostly white. Bill and feet black. Length about 6.50; wing 3.00; tail about 2.75; bill 0.50; tarsus 0.90; hind toe and claw 0.65. A protean species of extensive dispersion in Europe and Asia, occurring abundantly in Alaska; there is some uncertainty to what form the American bird strictly belongs. It is that with the whole side of the head, below the white stripe, slaty-blackish, and some dusky markings on breast; doubtless some Asiatic sub-species (*taivanus* Swinh.?)

14. Subfamily ANTHINÆ: Pipits, or Titlarks.

FIG. 158. — Meadow Pipit. (From Dixon.)

In these, the tail is shorter than the wings, and composed of broader feathers retaining their width to near the end; 4 or 5 primaries usually form the point of the wing; the tarsi are relatively shorter, usually about equal to the middle toe; the lateral toes are longer, the points of their claws reaching beyond the base of the middle claw; the hind claw is always lengthened and straightened (as in the figure beyond given of *Anthus ludovicianus*); and the coloration is "niggled," that is to say, broken up in streaks and spots. The species of *Anthinæ* make up nearly or about half the family; they are chiefly referable to the genus *Anthus*, of which, however, there are several subdivisions. In typical *Anthus*, the wing is longer than the tail, and its point is formed by the outer 4 primaries, the 5th being abruptly shorter; the hind claw is nearly straight, and nearly or quite equals its digit in length. *Neocorys* only differs in having the feet larger and tail shorter. In certain S. Am. forms, *Pediocorys* and *Notiocorys*, the wing is more rounded, and 4 or even 5 primaries enter into the tip of the wing; in several European subgenera only 3 primaries are abruptly longer than the succeeding ones. Our *Anthus* is strictly congeneric with the European *A. spinoletta*, type of the genus. About fifty species (among them six or eight Central and South American ones) are ascribed to *Anthinæ*. They are terrestrial and more or less gregarious birds, migratory and insectivorous.

31. **AN'THUS.** (Gr. *ἄνθος*, *anthos*, Lat. *anthus*, a kind of bird.) PIPITS. Bill shorter than head, about as wide as high at base, compressed in most of its extent, acute at tip, where distinctly notched; culmen slightly concave between base and terminal convexity; rictus slightly bristled. Wings longer than tail, tipped by the first 4 primaries, 5th abruptly shorter. Tarsi not shorter or rather longer than the hind toe and claw; inner lateral toe rather longer than the outer, or the two about equal. Tail extending beyond the end of the outstretched feet.

Markings of upper parts distinct, and shade of under parts greenish in . . . . . *pratensis* 88
Markings of upper parts obscure, and shade of under parts buffy in . . . . . *ludovicianus* 89

88. **A. praten'sis.** (Lat. *pratensis*, relating to *pratum*, a meadow. Fig. 158.) MEADOW PIPIT. Upper parts pale greenish-brown, distinctly marked with blackish-brown centres of the feathers; wing-quills and coverts clove-brown, edged with greenish-gray. Tail-feathers dark brown, edged with the greenish shade of the back, the outer one obliquely white for nearly half its length, and others with white at the end. Cheeks olivaceous, speckled with dusky. Under parts brownish-white with a tinge of green, marked on the breast and sides with brownish-black streaks running forward as a maxillary chain; chin, belly, and under tail-coverts unmarked. Bill dusky above and at end, the rest livid flesh-color; feet obscure flesh-color; iris blackish. Length about 6.00; extent 9.50; wing 3.00; tail 2.50; bill 0.50; tarsus 0.75. Europe; North American as occurring in Greenland, and also, it is said, in Alaska. I have seen Alaskan Pipits, certainly not *ludovicianus*, and apparently *pratensis;* but too young and in too bad condition to furnish decisive characters.

89. A. ludovicia'nus. (Lat. of Louisiana; 'Ludovicus, Louis.' Fig. 159.) LOUISIANA PIPIT. AMERICAN TITLARK. BROWN LARK. WAGTAIL. Upper parts dark brown with an olive shade, most of the feathers with dusky centres, giving an obscure streaky or nebulous appearance; eyelids, supereiliary line, and all under parts brownish-white, or pale buffy or ochrey brown, very variable in shade from muddy white to rich buff, the breast and sides of the body and neck thickly streaked with dusky; wings and tail blackish, the inner secondaries pale-edged, and 1–3 outer tail-feathers white wholly or in part. Bill blackish; pale at base below; feet brown. Length 6.25–6.75, sometimes 7.00; extent 10.25–11.00; wing 3.25–3.50; tail 2.75–3.00; bill 0.50; tarsus 0.90. N. Am., everywhere; an abundant and well-known bird of fields and plains; migratory; in the U. S. seen chiefly in flocks in fall, winter, and early spring; breeds in high latitudes, and in the Rocky Mts. above timber line as far south as Colorado; lays 4–6 very dark-colored eggs, 0.80 × 0.60, in a mossy or grassy nest on the ground; voice querulous, gait tremulous, flight vacillating.

FIG. 159.—Titlark, nat. size. (Ad nat. del. E. C.)

32. NEO'CORYS. (Gr. *νέος, neos*, new; *κόρυς, korus*, a helmet, and hence applied to a kind of crested lark.) SKY PIPITS. Characters of *Anthus*, from which little distinguished by the shorter and more nearly even tail and larger feet, which when outstretched reach beyond the end of the tail; tarsus shorter than hind toe and claw. Colors clearer and markings more distinct than in *Anthus ludovicianus*; more as in some European species of *Anthus*.

90. N. spra'guii. (To Isaac Sprague, of Mass.) SPRAGUE'S PIPIT. MISSOURI TITLARK. Above, variegated with numerous streaks of dark brown and gray, in largest pattern on the back, smallest on the nape, the gray constituting the edging of the feathers. Below, dull whitish, more or less brownish-shaded across the breast and along the sides; the breast sharply streaked, the sides less distinctly so, with dusky; a more or less evident series of maxillary spots. Quills dark grayish-brown; the inner ones, and the wing-coverts, edged with grayish-white, corresponding to the pattern of the back. Middle tail-feathers like the back; next ones blackish-brown, the two outer pair wholly or mostly pure white, the 3d pair from the outside usually touched with white near the end. With reduction of the gray edgings of the feathers of the upper parts by wearing away in summer, the bird becomes darker above, with narrower and sharper variegation, and the pectoral streaks are fainter. Bill blackish above; below, like the feet, pale flesh-color; iris black. After the fall moult the colors again become pure; the streaking of the upper parts is strong and sharp, and the under parts acquire a ruddy-brown shade. Young: Edgings of the feathers of the upper parts buffy, giving a rich complexion to the plumage; feathers of back with pure white edging, forming conspicuous semicircular markings; greater wing-coverts and long inner secondaries broadly tipped with white, and primaries broadly edged and tipped with white or buff. Ear-coverts buffy-brown, forming a more conspicuous patch than in the adult. Under parts strongly tinged, except on throat and middle of belly, with buffy-brown, the pectoral and lateral streaks large and diffused. Sexes indistinguishable; ♀ rather smaller than ♂. Length 6.25–6.75, rarely 7.00; extent 10.00–11.00, generally about 10.50, rarely 11.50; wing 3.00–3.30; tail 2.25–2.40; bill 0.50; tarsus 0.80–0.90; middle toe and claw 0.90; hind toe and claw nearly 1.00, the claw alone about 0.50. Central portions of the U. S., and adjoining British Provinces, from the eastern edge of the high central plains to the Rocky Mts., from the valleys of the Red River of the North and of the Saskatchewan to Texas; breeding in profusion in Dakota and Montana; nest on the ground, of fine dried grasses, sometimes arched over; eggs 4–5, 0.90 × 0.60, grayish-white minutely flecked with darker, giving a purplish cast. General habits and manners of titlarks; but soaring flight when singing, and the song itself, having all the qualities which have made the European skylark famous, and being no less worthy of celebration in poetry.

9. Family SYLVICOLIDÆ: American Warblers.

FIG. 160. — Black-throated Green Warbler, nat. size. (Ad nat. del. E. C.)

Primaries, nine; *rectrices*, twelve; tarsi scutellate; inner secondaries not enlarged, nor hind toe lengthened and straightened, as in the two preceding families; bill without a lobe or tooth near the middle of the commissure, as in *Pyranga*; not strongly toothed and hooked at end, as in *Lanius* and *Vireo* (which may have ten primaries), nor greatly flattened with gape reaching to eyes, as in *Hirundinidæ*, nor strictly conical with angulated commissure, as in *Fringillidæ*. The family presents such a number of minor modifications of form, that it seems impossible to characterize it, except negatively; in fact, it has never been satisfactorily defined. But doubtless the student will be able to assure himself that his specimen is a sylvicoline, by its not showing the peculiarities of our other nine-primaried Oscines. All the sylvicolas are *small* birds; excepting *Icteria*, and perhaps a species of *Siurus*, not one is over six inches long, and they hardly average over five. With few exceptions they are beautifully clothed in variegated colors; but the sexes are generally unlike, and the changes of plumage, with age and season of the year, are usually strongly marked, so that different specimens of the same species may bear to each other but little resemblance; this of course renders careful discrimination necessary. The usual shape of the bill may be called conoid-elongate (something like a slender minié bullet in miniature), but the variations in precise shape are endless. The rictus is usually bristled; the bristles sometimes have an extraordinary development, and are sometimes wanting. The wings are longer than the tail, except in *Geothlypis*, *Icteria*, and one or two exotic genera; neither the wing nor tail ever presents striking forms; the head is never crested. The feet have no special peculiarities, though they show some slight modifications corresponding to somewhat terrestrial, or more strictly arboricole, habits. The nidification is endlessly varied, more or less artistic or artless nests being built in trees, bushes, holes, or on the ground. Musical proficiency might be expected from the agreeably suggestive name of the family, but as a rule the "warbler's" singing is rather "quaint and curious" than very skilfully modulated or highly melodious, — to which statement, however, there is signal exception to be taken, as in the case of the *Siuri*. Some of the warblers have the habits of titmice or wrens; others of creepers or nuthatches; the *Siuri* closely resemble the titlarks in some respects, and have even been placed in the *Motacillidæ*; while the *Setophaginæ* simulate the *Tyrannidæ* (of a different suborder) so perfectly that they used to be classed with these clamatorial flycatchers. The warblers grade so perfectly toward the tanagers that they have all been made a subfamily of *Tanagridæ* (where possibly they belong). The affinity of some of them with the *Cærebidæ*, or honey-creepers of the tropics, is so close that the dividing line has not been drawn. The position of *Icteria* and its two associate exotic genera, *Granatellus* and *Teretristis*, is open to question; perhaps they come nearer *Vireonidæ*. It is probable that final critical study will result in a remapping of the whole

group; meanwhile, the very diversity of forms included in it enables us to mark off sections with ease.

This is the second largest family of North American birds, the *Fringillidæ* alone surpassing it in number of species. If not exactly "representative," in a technical sense, of the Old World *Sylviinæ*, it may be considered to replace that family in America, having much the same *rôle* in bird-economy; both families abound in species and individuals; they are small, migratory, insectivorous, and everywhere take prominent part in the make-up of the bird-fauna. There are upward of a hundred species of *Sylvicolidæ*, distributed over the whole of North and Middle America, and much of South America. The centre of abundance of the *Setophaginæ*, or flycatching warblers, is in the warmer parts of America; comparatively few species reach the United States, and only two or three are extensively dispersed in this country. On the other hand, the *Sylvicolinæ* are more particularly birds of North America; very few of the species are confined to Middle or South America; and *Dendrœca*, the leading type of this group, is the largest, most beautiful, and most attractive genus of North American birds, preëminently characteristic of this country. The warblers have we always with us, all in their own good time; they come out of the South, pass on, return, and are away again, their appearance and withdrawal scarcely less than a mystery; many stay with us all summer long, and some brave the winters in our midst. Some of these slight creatures, guided by unerring instinct, travel true to the meridian in the hours of darkness, slipping past "like a thief in the night," stooping at day-break from their lofty flights to rest and recruit for the next stage of the journey. Others pass more leisurely from tree to tree, in a ceaseless tide of migration, gleaning as they go; the hardier males, in full song and plumage, lead the way for the weaker females and the yearlings. With tireless industry do the warblers befriend the human race; their unconscious zeal plays due part in the nice adjustment of Nature's forces, helping to bring about that balance of vegetable and insect life without which agriculture would be in vain. They visit the orchard when the apple and pear, the peach, plum, and cherry are in bloom, seeming to revel carelessly amid the sweet-scented and delicately-tinted blossoms, but never faltering in their good work. They peer into the crevices of the bark, scrutinize each leaf, and explore the very heart of the buds, to detect, drag forth, and destroy those tiny creatures, singly insignificant, collectively a scourge, which prey upon the hopes of the fruit-grower, and which, if undisturbed, would bring his care to nought. Some warblers flit incessantly in the terminal foliage of the tallest trees; others hug close to the scored trunks and gnarled boughs of the forest kings; some peep from the thicket, the coppice, the impenetrable mantle of shrubbery that decks tiny water-courses, playing at hide-and-seek with all comers; others more humble still descend to the ground, where they glide with pretty mincing steps and affected turning of the head this way and that, their delicate flesh-tinted feet just stirring the layer of withered leaves with which a past season carpeted the ground. We may seek warblers everywhere in their season; we shall find them a continual surprise; all mood and circumstance is theirs.

As at present constituted, the *Sylvicolidæ*, comprising upwards of a hundred good species, may be divided into three subfamilies, the characters of which, given more at length beyond, may here be shortly contrasted: —

Analysis of Subfamilies.

Sylvicolinæ. — Wings longer than tail (except in *Geothlypis*); bill conical, slender; commissure slightly curved, with short bristles or none. Size moderate.

Icteriinæ. — Wings shorter than tail; bill compressed, high, very stout; commissure much curved, without any bristles; size very large.

Setophaginæ. — Wings longer than tail; bill broad, flattened; commissure slightly curved, with bristles reaching far beyond the nostrils.

Artificial Key to the Genera of Sylvicolidæ.

Length 7.00 inches or more . . . . . *Icteria* 43
Length 5.50 inches or more and tail-feathers plain . . . . . *Siurus* 40
Length under 5.50 or tail-feathers not plain.

Wing shorter than tail, or equal and head ashy . . . . . *Geothlypis* 42
Wing longer than tail, or equal and head not ashy
Tarsus shorter than middle toe and claw . . . . . *Mniotilta* 33
Tarsus not shorter than middle toe and claw.
Rictal bristles evidently reaching far beyond nostrils.
Tail black and orange, or black and white, or dark and yellow . . . . . *Setophaga* 46
Tail ashy edged with white, and head with red . . . . . *Cardellina* 45
Tail greenish, unmarked, or with white blotches . . . . . *Myiodioctes* 44
Rictal bristles evidently not reaching far beyond nostrils, or not evident at all.
Tail-feathers all unmarked.
Bill at least 0.50 inches long, very acute ; 4 black stripes on head, or none . *Helmintherus* 36
Bill not 0.50 inches long.
Wing over 2.50 inches ; bill not acute ; bright yellow below, or head ashy . *Oporornis* 41
Wing not over 2.50 inches ; bill very acute ; no bristles . . . . . *Helminthophila* 37
Tail-feathers blotched with white, or yellow on inner webs.
Rictal bristles not evident.
Bill not 0.50 inch long ; whole fore parts not yellow . . . . . *Helminthophila* 37
Bill at least 0.50 inch long ; whole fore parts yellow . . . . . *Protonotaria* 35
Rictal bristles very evident.
Back blue with gold spot, throat and legs yellow . . . . . *Parula* 34
Head orange-brown with black bar through eye . . . . . *Peucedramus* 38
Coloration otherwise . . . . . *Dendræca* 39

Diagnostics or Characteristics of some of the Genera of Sylvicolidæ.

Genera *Mniotilta*, *Parula*, and *Peucedramus* are *creeping warblers*, with certain slight modifications of the feet, enabling them to scramble about the trees much like creepers or nuthatches.

Genera *Geothlypis* and *Oporornis* are *ground warblers*, with the feet modified in adaptation to terrestrial life. Genus *Siurus* is similar in this respect; the species *walk* on the ground, and act in some respects like Motacillines.

Genera *Protonotaria*, *Helmintherus*, and *Helminthophila* are "*worm-eating*" *warblers* (the old genus Vermivora), with slight rictal bristles or none.

Genera *Setophaga*, *Cardellina*, and *Myiodioctes* are *fly-catching warblers*, with strongly bristled bill and muscicapine habits, in some respects like species of *Tyrannidæ*.

Genus *Icteria* is isolated by its peculiarities of form and habits, and great size for this family.

Genus *Dendræca* comprehends the *wood warblers par excellence*, — the largest genus, with over twenty species.

BILL : — Peculiarly stout, high, and compressed in *Icteria* ; — flattish, and strongly bristled in *Setophaga*, *Cardellina* and *Myiodioctes* ; — large, with straightish outlines, scarcely or not bristled, and very acute in *Protonotaria* and *Helmintherus* ; — small, unbristled, and very acute in *Helminthophila*.

FEET : — Tarsus longest, slenderest, and usually pale-tinted in the *ground warblers* ; — shortest in the *creeping warblers*, with relatively longest toes.

WINGS : — Shorter than the tail in *Icteria* and species of *Geothlypis* ; — about equal to the tail in species of *Geothlypis*, *Siurus*, *Setophaga*, and *Cardellina* ; — usually decidedly longer than the tail.

TAIL : — The feathers (some or all) *blotched with white* in the following: *Mniotilta*, *Parula*, *Protonotaria*, species of *Helminthophila*, *all Dendræcæ* excepting *D. æstiva*, *Peucedramus*, one *Myiodioctes*, one *Setophaga*. The feathers plain olivaceous, or otherwise like the back, unmarked, in species of *Helminthophila*, in *Helmintherus*, *Oporornis*, *Geothlypis*, *Siurus*, *Icteria*, species of *Myiodioctes*, *Cardellina* ; yellow and dark in one *Setophaga* and one *Dendræca*.

15. Subfamily SYLVICOLINÆ: True Warblers.

Bill conoid-elongate, shorter than head, about as high as, or rather higher than wide opposite the nostrils, not hooked, and with but a slight notch, if any, at tip : commissure straight or slightly curved; a few rictal bristles, reaching little, if any, beyond the nostrils, or none. Wings pointed, usually longer than the narrow, nearly even tail.

This beautiful group, which comprehends the great majority of the Warblers, is specially characteristic of North America, and reaches its highest development in the eastern portions of the continent, mainly through the preponderance of species of the largest genus, *Dendræca*. All the genera and most of the species of *Sylvicolinæ* are found in this country, mainly as migrants, which appear in the spring, pass the summer, and retire for the winter to Mexico, the West Indies, and Central or even South America; though some pass the inclement season within our limits, and one at least is found in winter in Northern States.

Here belong the genera *Mniotilta, Parula, Protonotaria, Helmintherus, Helminthophila, Peucedramus, Dendrœca, Siurus, Oporornis,* and *Geothlypis.*

33. **MNIOTIL'TA.** (Gr. *μνίον, mnion,* moss, and *τίλλω, tillo,* I pluck, or *τιλτός, tiltos,* plucked; conjectural application to the nest-building.) CREEPING WARBLERS. Coloration entirely black-and-white; tail-feathers white-blotched. Tarsus not longer than middle toe and claw; hind toe long, with large claw. Wings long, pointed, 1st primary about as long as 2d; tail nearly even, much shorter than wing. Bill nearly as long as head, slender, much compressed, with concave lateral outlines, and curved culmen and gonys, slightly notched and bristled. Only one good species.

91. **M. var'ia.** (Lat. *varia,* variegated. Fig. 161.) BLACK-AND-WHITE CREEPER. ♂, adult: Black; edges of feathers of upper parts, coronal, superciliary, and maxillary stripes, tips of greater and median wing-coverts, outer edges of inner secondaries and inner edges of quills and tail-feathers, and spots on inner webs of lateral tail-feathers, white: under parts mostly white, with black streaks on sides and crissum: bill and feet black. ♀ similar: less black in proportion to the white, being mostly white below. Length 5.00–5.25: extent 8.25–8.75; wing 2.35–2.75; tail 2.25; bill nearly 0.50. Eastern N. Am.; N. to the Fur Countries: W. to Dakota; migratory: breeds throughout its range; winters from the southern border southward. A common bird of woodland, thicket, and swamp, generally seen scrambling actively about the trunks and larger branches of the trees, rather like a nuthatch than like a creeper, the tail not being used as a prop. Nest on the ground, or in a stump, of bark-strips, mosses, grasses, leaves, hair, etc.; eggs 4–5, 0.70 × 0.52, white, profusely marked with reddish and other dots.

FIG. 161. — Black-and-white Creeper, nat. size. (Ad nat. del. E. C.)

92. **M. v. borea'lis?** (Lat. *borealis,* northern; *boreas,* the north wind.) SMALL-BILLED CREEPER. Northerly specimens said to have the bill shorter and straighter.

34. **PA'RULA.** (Lat. *parula,* diminutive of *parus,* a tit.) BLUE YELLOW-BACKED WARBLERS. Coloration highly variegated: tail-feathers white-blotched; back bluish, with yellowish spot; throat yellow, with dark spot; feet pale. Size very small — under 5.00 inches. Bill short, stoutish; the notch obsolete, the bristles slight though evident. Two very distinct species in N. Am.

93. **P. america'na.** (Lat. of America: said to be named not for the Italian navigator, but from a mountain in Central America?) ♂, in spring: Upper parts clear ashy-blue: middle of back with a patch of greenish-yellow or brownish-golden. Lores dusky. A white spot on each eyelid. Wings blackish, crossed on the ends of the greater and middle coverts with two broad white bars; primaries narrowly, secondaries more broadly, edged externally with the color of the back, internally with white. Tail like wings, with much edging of outer webs like the back, the middle feathers mostly bluish; at least two outer feathers on each side with large, white, squarish patches on the inner web near the end, usually third feather blotched with white, and a white touch on fourth or even fifth feather. Chin and throat yellow, rather narrowly confined, this yellow spreading over the whole breast, but much of breast spotted or tinged with orange-brown, and jugulum showing even a decided blackish collar; coloration of this part very variable; sometimes reddish-brown markings along the sides, much as in the chestnut-sided warbler. Rest of under parts white. Bill above black; below whitish or flesh-colored, drying yellowish. Legs pale. Length 4.50–4.75; extent 7.00–7.50: wing 2.10–2.30; tail 1.75. ♀, in spring: Like the ♂; upper parts less brightly bluish, or with slight greenish gloss; back-patch not so well defined; less white on tail; white wing-bands narrower; dark or reddish tinting of the fore breast less decided or scarcely indicated; the yellow itself more restricted. Young: Bluish of upper parts glossed over with greenish, sometimes to such extent

as to obscure the dorsal patch, which is then not very different from the rest of the upper parts. White tail-spots smaller, generally confined to two outer feathers on each side. White wing-bands narrower. Edging of tail and wings tinged with greenish, like the back. Eyelids not spotted with white. Yellow of fore under parts pale, with little or no indication of the dusky across the jugulum. White of the under parts tinged with yellowish posteriorly, and frequently showing brownish touches along the sides. Eastern U. S. and British Provinces; W. sometimes to the Rocky Mts.; migratory; breeds in the greater part of its N. American range, but chiefly northerly; winters from Florida southward. An elegant, diminutive species, abundant in high open woods, where it is generally observed fluttering among the smallest twigs and terminal foliage. Nest in trees, an elaborate woven structure of mosses and lichens; eggs 4–5, 0.62 × 0.48, white with the usual sprinkling of reddish and other dots.

94. P. nigrilo'ra. (Lat. *niger*, black; *lorum*, a bridle; applied to the space between eye and bill of a bird.) SENNETT'S WARBLER. ♂, adult: Upper parts of the same ashy-blue color as in *P. americana*, with a dorsal patch of greenish-yellow exactly as in that species. Wings also as in *americana*, dusky, with grayish-blue outer, and whitish inner, edgings, and crossed by two conspicuous white bars across tips of greater and middle coverts. Tail as in *americana*, but the white spots smaller and almost restricted to two outer feathers on each side. Eyelids black, *without* white marks. Lores broadly and intensely black, this color extending as a narrow frontal line to meet its fellow across base of culmen, and also reaching back to invade the auriculars, on which it shades through dusky to the general bluish. Under parts yellow as far as the middle of the belly, and a little farther on the flanks, and also spreading up the sides of the jaw to involve part of the mandibular and malar region; on the fore breast deepening into rich orange, but showing nothing of the orange-chestnut and blackish of *P. americana*. Lower belly, flanks and crissum white. Bill black above, yellow below. Legs undefinable light horn-color. Length about 4.50; wing 2.00–2.20; tail 1.80–1.90; bill from nostril 0.38–0.40; tarsus 0.62–0.65; middle toe alone 0.40. Texas. Another little exquisite, recently added to our fauna; quite distinct from, though resembling, *P. americana;* coming nearer *P. pitiayumi*, a Mexican species.

35. PROTONOTA'RIA. (Low Lat. *protonotarius*, first notary, or scribe; why?) GOLDEN SWAMP WARBLERS. Bill of great size, nearly as long as head, compressed, conic, acute, with slightly notched tip and scarcely bristled rictus. Wings pointed, unmarked, much longer than the short, nearly even, spotted tail. Tarsus equal to middle toe and claw. One species.

95. P. cit'rea. (Lat. *citrea*, pertaining to the citron; i. e., yellow.) PROTHONOTARY WARBLER. Golden-yellow, paler on the belly, changing to olivaceous on the back, thence to bluish-ashy on the rump, wings, and tail; most of the tail-feathers largely white on the inner webs; no other special markings; bill entirely black, very large, at least 0.50 long. Length about 5.50; extent 9.25; wing 2.75–3.00; tail 2.25; tarsus 0.75. Sexes similar. In highest feather the yellow of the head sometimes becomes orange-red. Eastern United States, southerly; north casually to Maine, New Brunswick, and Ohio; regularly to Illinois and Kansas; west to Indian Territory and Texas; winters extra-limital. A beautiful species, of striking form and colors, and sedate manners, inhabiting swamps and thickets; nest in holes, or other sheltered cavities in trees, stumps, and logs, of the most miscellaneous materials; eggs 4–5, 0.68 × 0.54, creamy white, profusely speckled.

36. HELMINTHE'RUS. (Gr. ἕλμις, gen. ἕλμινθος, *helmis, helminthos*, a bug; ἠ..., an animal; i. e., ἑλμινθοθήρας, *helminthotheras*, a bug-hunter; like *vermivora*, worm-eating.) WORM-EATING SWAMP WARBLERS. Bill large, conic-acute, especially high and stout at the base, nearly or quite as long as head, unnotched and scarcely or not bristled. Wings rather pointed, much longer than the little rounded tail. Tarsus about equal to middle toe and claw. Sexes similar; tail-feathers unmarked; legs pale. Two very distinct species.

96. H. vermi'vorus. (Lat. *vermivorus*, worm-eating; *vermis*, a worm, *voro*, I devour. Fig. 162.)

Worm-eating Warbler. Olive, below buffy, paler or whitish on the belly; head buff, with four black stripes, two along sides of crown from bill to nape, one along each side of head through the eye; wings and tail olivaceous, unmarked; bill and feet pale; bill acute, unbristled, unnotched, at least 0.50. Length 5.50; extent 8.75; wing 2.75–3.00; tail 2.00–2.25. The distinctive head-stripes appear before the bird is fully fledged. Eastern U. S., rather southerly, but north regularly to the Middle States, casually to Maine; west to Kansas, Missouri, and the Indian Territory; breeds throughout its U. S. range; winters from Florida southward; common in woods, shrubbery, and swamps; a bird of rather slow and sedate movements; nest on the ground, of leaves, grasses, rootlets; eggs 4–5, crystal-white, minutely dotted with reddish-brown, 0.70 × 0.50.

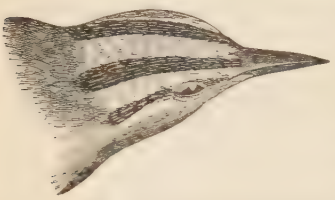

Fig. 162. — Worm-eating Warbler, nat. size. (Ad nat. del. E. C.)

97. **H. swain'soni**. (To Wm. Swainson.) Swainson's Warbler. Somewhat similar to the last; no black head stripes; no *decided* markings anywhere. Upper parts dark olive-brown, nearly uniform, but browner on exposed surfaces of wings and tail, and quite clear brown on the crown. A long light superciliary stripe. Under parts dull sordid whitish, shaded on the sides with the color of the back. Middle tail-feathers with obsolete wavy cross-bars. Bill brown above, pale below; feet pale. Large: length nearly 6.00; wing 2.75, pointed, tip formed by 1st –3d quills; tail 2.00, emarginate; bill of great size, 0.65 along culmen, about equalling tarsus in length, deep at base, with straight upper mandible rising high on forehead; thus shaped something like a meadow-lark's. A rare and curious species, confined to the South Atlantic States. I have seen but three specimens; the description is from Audubon's type.

37. **HELMINTHO'PHILA**. (Gr. ἕλμις, ἕλμινθος, *helmis*, *helminthos*, a bug; φιλέω, *phileo*, I love.) Worm-eating Warblers. Bill slender and exceedingly acute, unnotched, unbristled (fig. 163). Wings pointed, longer than the nearly even tail, — in one species nearly half as long again. Tarsi longer than middle toe and claw. Tail-feathers in some species white-blotched, in others plain, — the former being otherwise of bright and variegated colors, the latter more simply clad. Nest on the ground or quite near it (excepting in the case of *H. luciæ*); eggs white, spotted. To the eight established species of the genus have lately been added three others; but one of them is almost certainly a hybrid between *H. pinus* and *Oporornis formosa*, while the other two are probably hybrids between *H. pinus* and *H. chrysoptera*. There has also been added a variety of *H. celata*. These are enumerated beyond, but only the eight established species are considered in the analysis of the genus. Even with this reduction, *Helminthophila* is still the second largest genus of the subfamily. It is peculiarly North American, all the known species occurring in this country, some of them not being known to occur elsewhere. The genus may be divided according to coloration into two groups, which correspond in a general way with geographical distribution. Three species (*H H. pinus*, *chrysoptera*, and *bachmani*), exclusively eastern, are of variegated colors, the tail-feathers white-blotched as in *Dendrœca*. In the other five the coloration is simpler; the tail-feathers are not, or not conspicuously, blotched with white, and all but one of these species have a crown-patch; one of them is Eastern, two are Western, and two of general dispersion. The natural analysis of the species, and a shorter key to them, are subjoined; these tables should suffice to identify any adult male specimens, but females and young, particularly of Nos. 5, 6, 7, require detailed descriptions for their recognition. (In *H. peregrina*, with tail normally plain, the outer feather is sometimes distinctly white-blotched.)

Fig. 163. — *H. chrysoptera*, nat. size. (Ad nat. del. E. C.)

Natural Analysis of Species.

I. Tail-feathers conspicuously white-blotched. Wings with white or yellow on coverts. Head or breast with black. All exclusively Eastern.

1. Bluish-ash, below white; crown and wing-bars yellow; throat and stripe on side of head black *chrysoptera* 102
2. Olive-green; wings and tail bluish-ash, former with white or yellow bars; crown and under parts yellow; lores black . . . . . *pinus* 98
3. Olive-green, below yellow; throat, breast, and crown-patch black; forehead yellow . *bachmani* 103

II. Tail-feathers inconspicuously or not blotched with white. No decided wing-markings. No black anywhere.

a. Crown without colored patch. Wings about half as long again as tail

4. Tail with obscure whitish spot on outer feather; under parts white or whitish; upper parts olive-green, brighter behind, quite ashy in front. Chiefly Eastern . . . . . *peregrina* 109

b. Crown with colored patch. Wings shorter.

5. Crown-patch orange-brown; tail unmarked; upper parts olive-green, under parts greenish-yellow, both nearly uniform. Western and incompletely Eastern . . . . . *celata* 107, 108
6. Crown-patch chestnut; tail unmarked; upper parts olive-green, growing ashy on head; under parts uniformly yellow. Eastern and incompletely Western . . . . . *ruficapilla* 106
7. Crown-patch chestnut; tail unmarked; above olivaceous-ash, below whitish; rump and under tail-coverts bright yellow; breast yellowish. Western . . . . . *virginiæ* 105
8. Crown-patch and upper tail-coverts chestnut; outer tail-feather with dull white patch; above pale cinereous, below white. Southwestern . . . . . *luciæ* 104

Pass-key to the Species.

Tail-feathers white-blotched — bluish, crown yellow, throat black . . . . . *chrysoptera* 102
— greenish, crown and all under parts yellow . . . . . *pinus* 98
— greenish, crown (partly) and throat black . . . . . *bachmani* 103
— upper tail-coverts chestnut, crown-patch chestnut . . . . . *luciæ* 104
Tail-feathers all unmarked — upper tail-coverts — yellow; crown-patch chestnut . . . . . *virginiæ* 105
— not yellow; crown-patch — chestnut . . . *ruficapilla* 106
— orange-brown . *celata* 107, 108
— wanting . . . *peregrina* 109

98. H. pi'nus. (Lat. *pinus*, a pine-tree.) BLUE-WINGED YELLOW WARBLER. ♂, adult: Fore part of crown and entire under parts rich yellow; upper parts yellow-olive, becoming slaty-blue on the wings and tail (system of coloration thus like that of *Protonotaria*). Wings with two white or yellowish bars; tail with several large white blotches; under tail-coverts white; eyelids bright yellow; small stripe through eye black; bill blue-black. Female and young not very dissimilar; duller and more olivaceous. Length about 4.75; extent 7.50; wing 2.40–2.50; tail 2.00–2.10; tarsus 0.65; bill 0.45. Eastern United States, north to Massachusetts and Minnesota, west to Kansas, Indian Territory, and Texas; common, migratory, breeding in its United States range, wintering extralimital. Nest on the ground, eggs 4–5, 0.67 × 0.48, white, sprinkled with reddish-brown dots.

99. H. lawren'cii? (To Geo. N. Lawrence, of N. Y.) LAWRENCE'S WARBLER. Like *H. pinus;* but a large black patch on the throat and breast, and broad black eye-stripe, reaching over auriculars, as in *H. chrysoptera;* thus *pinus* × *chrysoptera*, and doubtless a hybrid between the two. New Jersey; two specimens noted to date.

100. H. leucobronchia'lis? (Gr. λευκός, *leucos*, white, βρόγχος, *brogchos*, becoming *bronchus*, throat.) WHITE-THROATED WARBLER. Like *H. chrysoptera;* but a black bar through the eye as in *pinus*, and lacking the black breast-patch of *chrysoptera*, the entire under parts being white; thus *chrysoptera* × *pinus*, and doubtless a hybrid between the two, though up to date a dozen or more specimens have been described, from New England, New York, Pennsylvania, and Michigan.

101. H. cincinnatien'sis? (Of Cincinnati, Ohio, where discovered.) CINCINNATI WARBLER. Like *H. pinus* in color; bill with evident rictal bristles; no white wing-bars or tail-blotches; no ashy-blue on wings or tail; concealed black on crown and sides of head like the incompleted black mask of *Oporornis formosa*, with which the bird otherwise closely agrees in color; thus curiously being *H. pinus* × *O. formosa*. Length 4.75; wing 2.50; tail 1.85; bill 0.44. One specimen known, Ohio.

102. H. chrysop'tera. (Gr. χρυσός, *chrusos*, golden, and πτερόν, *pteron*, wing.) BLUE GOLDEN-WINGED WARBLER. ♂, adult: Upper parts slaty-blue, or fine bluish-gray; crown, and large wing-patch formed by confluent wing-bars, rich yellow; a broad stripe on side of head and patch on chin, throat and fore-breast, black, the eye-stripe bordered above and below with white; under parts generally, excepting the black breast-plate, white, often tinted with yellowish, and shaded on the sides with ashy. Exposed surfaces of wings and tail like upper parts; great white blotches on three lateral tail-feathers; bill black; feet dark. ♀ and immature specimens have the back more or less glossed with yellowish-olive; the yellow of the crown obscured with greenish; the black eye-stripe and breast-plate veiled with gray tips of the feathers, or not at all evident. Size of *H. pinus*. A beautiful species, common in Eastern United States and Canada; migratory, breeding anywhere in its United States range; nest and eggs like those of *H. pinus*.

103. H. bach'mani. (To Rev. John Bachman, of S. C.) BACHMAN'S WARBLER. ♂: Upper parts yellowish-olive, including sides of head and neck, tinged with ashy on the hind head; forehead and under parts bright yellow; a band on the vertex separating yellow front from ashy occiput, and the throat and fore breast, black, this breast-plate isolated in yellow surroundings. Wings dusky, glossed with the color of the back on all the exposed surface. Two or three outer tail-feathers white-blotched. Small; length 4.50; wing 2.35; tail 2.00. South Atlantic States, extremely rare, only known to occur in South Carolina, Georgia, and Cuba.

104. H. lu'ciæ. (To Miss Lucy Baird, daughter of Prof. S. F. Baird.) LUCY'S WARBLER. ♂ ♀, adult: Clear ashy-gray. Beneath white, with a faint tinge of buff on the breast. A rich chestnut patch on the crown, and upper tail-coverts of the same color. A white eye-ring. Quills and tail-feathers edged with the color of the back or whitish. Lateral tail-feather with an obscure whitish patch. Lining of wing white. Feet dull leaden-olive. Iris dark brown or black. Length 4.33–4.66; extent 7.00–7.50; wing 2.25–2.50; tail 1.75–2.00; tarsus 0.66; bill 0.25–0.33. Young: Lack the chestnut of the crown, though that of the rump is present. The throat and breast are milk-white, without the ochrey tinge of the adults; the wing-coverts are edged with pale rufous. The chestnut upper tail-coverts, and absence of any trace of olivaceous or yellowish coloration, distinguish this interesting species, the general superficial aspect of which is quite like that of a *Polioptila*. Valley of the Colorado and Gila; not yet known except from Arizona. The exceptional nidification of this species of the genus (Am. Nat., vi, 1872, p. 493) has been confirmed: nest in crevice behind bark of a tree or bush, such as a wren might select; eggs 4, not peculiar, being white dotted with reddish.

105. H. virgin'iæ. (To Mrs. Virginia Anderson, wife of the discoverer.) VIRGINIA'S WARBLER. ♂, in summer: Ashy-plumbeous, alike on the back, and top and sides of head. Below dull whitish, the sides shaded with ashy. Lining and edge of wings white. Upper and under tail-coverts, and isolated spot on the breast, yellow, in strong contrast with all surroundings. A white ring round eye. Wings and tail without yellowish edgings. Crown with a chestnut patch, as in *H. ruficapilla*. Length 4.75; extent 7.50; wing 2.25–2.50; tail 2.25. ♀, in summer: The yellow duller and slightly tinged with greenish; that of the breast, and the chestnut of the crown, more restricted. Autumnal specimens resemble the ♀; but in both sexes the plumbeous of the upper parts has a slight olive shade, and in birds of the year the crown-patch may be wanting. Southern Rocky Mt. Region; north to Colorado, Nevada, and Utah at least. Nests on the ground, like others of the genus; eggs indistinguishable from those of allied species.

106. H. ruficapil'la. (Lat. *rufus*, rufous; *capillus*, hair.) NASHVILLE WARBLER. ♂, in summer: Upper parts olive-green or yellowish-olive, clearer and brighter on the rump and upper tail-coverts. Top and sides of the head and neck ashy, with a veiled chestnut patch on the crown, and a white ring round the eye. No superciliary stripe. Lores pale. Wings and tail

fuscous, edged with the color of the back. Entire under parts yellow, including under wing-coverts and edge of the wing, the sides shaded with olive. Length 4.50–4.75; extent 7.50; wing 2.33–2.50; tail 1.75–2.00. ♀, in summer: Similar. Head less purely ashy. Crown-patch smaller and more hidden, if not wanting. Yellow of under parts paler, whitening on the belly. Autumnal specimens, of both sexes, though quite as yellow below as in summer, have the ash of the head glossed over with olivaceous, and in birds of the year the crown-patch may be entirely wanting. This species is distinguished by the rich clear yellow of the under parts at all seasons. In *H. celata*, which is next most yellow below, the color has a greenish cast; the head is little, if any, different from the rest of the upper parts, and the crown-patch is orange-brown. Temperate North America, but especially the Eastern Province; west only rarely to Utah, Nevada, and even California. A common bird, migratory in most of its U. S. range, but breeding in New England (and farther south in alpine regions) and thence northward. Nest on the ground, like the others, and eggs not peculiar.

107. **H. cela'ta.** (Lat. *celata*, concealed, as is the orange on the crown.) ORANGE-CROWNED WARBLER. ♂ ♀, in summer: Upper parts olive, duller and washed with grayish toward and on the head, brighter and more yellowish on the rump and upper tail-coverts. Beneath greenish-white, palest on the belly and throat, more olive-shaded on the sides; the color not pure, but rather streaky, and having in places a grayish cast. Wings and tail edged with the color of the back; lining of the wings like the belly, and inner edges of tail-feathers whitish. Orbital ring and lores yellowish. An orange-brown patch on the crown, partially concealed, smaller and more hidden in the ♀ than in the ♂. Length 4.80–5.20; extent 7.40–7.75; wing 2.30–2.50. Resembling the last, and often difficult to distinguish in immature plumage; but a general *oliveness* and *yellowness*, compared with the ashy of some parts of *ruficapilla*, and the different color of the crown-patch in the two species, will usually be diagnostic. The sexes of this species scarcely differ, and young or autumnal birds are very similar to the adults, except the frequent or usual absence of the orange-brown crown-spot in birds of the year. The species is well distinguished from all its allies by the color of the crown-patch. North America at large, but especially the Western and Middle regions; rare or occasional in the Eastern Province; north to high latitudes in British America and Alaska; migratory; breeds in Arctic regions and in alpine localities further south; nest and eggs not peculiar.

108. **H. c. lutes'cens.** (Lat. *lutescens*, growing yellowish.) PACIFIC ORANGE-CROWNED WARBLER. Differs in being much more richly colored. It may be described simply as olive-green above, and greenish-yellow, shaded with olive on the sides, below, without any of the qualifying terms required for precision in the case of typical *celata*. Pacific Coast region, Alaska to Lower California.

109. **H. peregri'na.** (Lat. *peregrina*, wandering, alien, foreign; i. e., migratory.) TENNESSEE WARBLER. ♂, adult: Upper parts yellowish-olive, brightest posteriorly; on the fore parts and head changing to pure ash, without any greenish tint whatever. No crown-patch of any different color. Lores, eye-ring, or frequently a decided superciliary stripe, whitish. Entire under parts dull white, scarcely or not tinged with yellowish. Wings and tail dusky, strongly edged with the color of the back, the outer tail-feathers frequently with an obscure whitish spot. Bill and feet dark. Length 4.50–4.75, rarely to 5.00; extent 7.50–8.00; wing about 2.75, thus long for the size of the bird, and especially in comparison with the short tail, pointed, with little difference in length between the first three or four quills; tail only 2.00 *or less*, thus remarkably short; the comparative length of wings and tail, with other characters, probably always distinguishes the species from the foregoing. ♀, adult: Quite like the ♂, but ashy of the head less pure and clear, and under parts more or less tinged with greenish-yellow. Young: Entire upper parts strongly and uniformly yellowish-olive, like the rump of the adult ♂, or even brighter, this color also tinging the eye-ring and superciliary stripe. Under parts as in the adult ♀, or more decidedly greenish-yellow, leaving only the belly and crissum whit-

ish. In this condition specimens more closely resemble some other species than when adult; but the short tail, long wings, and no crown-patch, should be distinctive. Chiefly Eastern North America, but west to the Upper Missouri region and in Colorado to the Rocky Mts.; common, especially in the Mississippi Valley, but less so in the Atlantic States; migratory; breeds in New England and the northern tier of States, and thence to high latitudes in British America; nest and eggs as in other species of the genus.

38. **PEUCE'DRAMUS.** (Gr. *πεύκη, peuke*, a pine, and *δραμεῖν*, to run.) OLIVE WARBLERS. General aspect of *Dendrœca*. Tongue much as in that genus, but larger, with revolute edges, cleft tip, and laciniate for some distance from the end. Wings elongated, half as long again as the tail (in *Dendrœca* but little longer than the tail), reaching, when folded, nearly to the end of the tail. Tail emarginate. Tarsus no longer than the middle toe and claw. Hallux little if any longer than its claw. Bill little shorter than tarsus (averaging little over half the tarsus in *Dendrœca*), attenuate, notably depressed, yet very little widened at base. Culmen rather concave than convex in most of its length, the under outline almost perfectly straight from extreme base to tip. Nasal fossæ very large, with a highly developed nasal scale. Rictal vibrissæ few and short. Plumage without streaks. One species known.

110. **P. oliva'ceus.** (Lat. *olivaceus*, olivaceous in color; *oliva*, an olive.) OLIVE WARBLER. ♂: Upper parts ashy, more or less olivaceous, changing to greenish on the nape. Head and neck all around orange-brown or intense saffron-yellow, with a broad black bar on the side of the head through the eye. Wings blackish, the inner webs of all the quills edged with white, the outer webs of most of the primaries with whitish, and the outer webs of the secondaries with greenish; most of the primaries also marked with white on the outer webs at base, forming a conspicuous spot (only seen elsewhere in *D. cœrulescens*, which is altogether different in other characters). Tail like the wings, with greenish edging of most of the feathers, the two outer ones on each side mostly or wholly white. Belly and sides whitish, tinged with olive or brownish. Basal half of under mandible light brown. Length 4.75–5.25; extent 8.25–9.00; wing 2.75–3.10; tail 2.25–2.55; bill 0.55; tarsus 0.75. The female is described as having the saffron color much clearer yellowish, and shaded with olive-green on the crown; the black bar replaced by whitish, excepting a dusky patch on the auriculars. A remarkable Mexican warbler, lately ascertained to inhabit Arizona, especially in mountainous localities; probably also Texas and New Mexico. It has much the habits of the pine-creeper; the nest and eggs are still unknown.

39. **DENDRŒ'CA.** (Gr. *δένδρον, dendron*, a tree, and *οἰκέω, oikeo*, I inhabit.) WOOD WARBLERS. Bill variable in shape, usually conico-attenuate, more or less depressed at base, compressed from the middle, notched near the tip, not showing the extreme acuteness of that of *Helmintherus*, *Helminthophila*, and *Protonotaria*. Rictus with obvious bristles, which are not evident in the true "worm-eating" warblers. Tarsus longer than the middle toe and claw (it is shorter, or not longer, in *Mniotilta*). Hind toe little if any longer than its claw (decidedly longer in *Mniotilta* and *Parula*). Wings much longer than tail, pointed, 1st and 2d primaries longest. Tail moderate, with rather broad feathers, nearly even, but varying to slightly rounded, or with slight central emargination. Pattern of coloration indeterminate. Tail always with white blotches (except in *æstiva* and its immediate allies, where the inner webs are yellow), never plain olivaceous. Crown never with lateral black stripes, nor under parts uniformly streaked with blackish on a pale ground, nor back with a yellow patch, nor whole head yellow. Length usually five or six inches; rarely under and perhaps never over these dimensions. Nest in bushes or trees, with rare exceptions. Eggs white, spotted. It is not easy to frame a definition of this genus covering all its modifications, yet introducing no term inapplicable to any species; but the foregoing expressions considered collectively, however arbitrary or trivial some of them may seem to be, will serve to distinguish any *Dendrœca* from its allies of other genera; and, if so, the diagnosis is exclusively pertinent to the group as con-

ventionally accepted. The coloration of the rectrices is a good clue to this genus; for all the species (excepting *D. æstiva* and its exotic conspecies) have the tail-feathers always blotched with white, —a feature only shown, among North American allies, in *Mniotilta*, *Parula*, *Protonotaria*, *Peucedramus*, and some species of *Helminthophila*, *Myiodioctes*. There is as much uniformity in the nest and eggs of *Dendrœca* as in those of *Helminthophila*. Whereas all these nest on the ground, as far as known all the *Dendrœcæ* nest in trees and bushes, with the single exception of *D. palmarum*. Excepting *D. castanea*, the eggs are essentially similar; all being white, variously speckled, dotted, or blotched with shades of reddish and darker brown, and lilac or purplish shell-spots. About thirty-five species are current, but not all of them are well established; they all occur within our limits excepting these: *pityophila* (Cuba), *adelaidæ* (Porto Rico), *pharetra* (Jamaica), *eoa* (Jamaica), *aureola* (Galapagoes), *capitalis* (Barbadoes), and *petechia* (West Indies) with its several tropical forms, all like our *æstiva*. Of the twenty-six species which have been ascribed to North America, one, *olivacea*, has since been made type of the genus *Peucedramus;* while of "montana" and "carbonata" nothing is now known: leaving twenty-three species to be treated, nearly as in the original edition of the Key, there having been but one North American accession to the genus since 1872, though two varieties (respectively of *dominica* and of *palmarum*) have meanwhile been described. *D. tigrina* has been made type of a genus *Perissoglossa;* but it remains to be seen whether other warblers do not possess the same peculiarities of the tongue. The following artificial analysis will facilitate the determination of our twenty-three established species; I believe it to be an infallible key to the perfect male plumages, and that it will probably hold good for spring specimens of both sexes of many species; but it will fail for nearly all autumnal and most female specimens of (**b**). It is difficult if not impossible to meet the varied requirements of these by rigid analysis; and recourse must be had to the detailed descriptions of the species arranged in what seems to be their natural sequence. The supplementary table of certain diagnostic marks may prove of much assistance, though it is not a complete analysis.

Analysis of perfect Spring Males.

Tail-feathers edged with yellow; head — yellow . . . . . *æstiva* 111
— chestnut . . . . . *vieilloti* 111*a*
Tail-feathers blotched with white; a white spot at the base of primaries . . . . . *cærulescens* 117
— no white spot at base of primaries. (**a**)

(**a**) Wing-bars not white. Below, white, sides chestnut-streaked, crown yellow . . . . . *pennsylvanica* 124
— yellow; sides reddish-streaked, crown reddish . . . . . *palmarum* 132, 133
— black-streaked; above, ashy . . . . . *kirtlandi* 131
— olive, reddish-streaked . . *discolor* 127

(**a**) Wing-bars white (sometimes fused into one large white patch). (**b**)

(**b**) Crown blue, like the back; below white, sides and breast streaked . . . . . *cærulea* 118
— chestnut, like the throat; below, and sides of neck, buffy-tinged . . . . . *castanea* 123
— clear ash; rump and under parts yellow, breast and sides black-streaked . . . . . *maculosa* 125
— blackish, with median line orange-brown, like the auriculars; rump yellow . . . . . *tigrina* 126
— perfectly black; throat black; a small yellow loral spot . . . . . *nigrescens* 116
— not black; no yellow; feet flesh-color . . . . . *striata* 122
— with yellow spot; throat flame-color; rump not yellow . . . . . *blackburnæ* 121
— white; rump and sides of breast yellow . . . . . *coronata* 119
— yellow; rump and sides of breast yellow . . . . . *auduboni* 120

(**b**) Crown otherwise; throat black; back ashy, streaked, rump ash, crown yellow . . . . . *occidentalis* 113
— blackish, rump black, crown blackish . . . . . *chrysoparia* 115
— olive; crown like back . . . . . *virens* 112
— not like back . . . . . *townsendi* 114
— yellow; back olive; no black or ashy on head . . . . . *pinus* 134
— ashy-blue; cheeks the same; eyelids yellow . . . . . *graciæ* 128
— black; eyelids white . . . . . *dominica* 129, 130

Diagnostic marks of certain Warblers in any plumage.

Wing-bars and belly yellow . . . . . *discolor* 127
Wings and tail dusky, edged with yellow . . . . . *æstiva* or *vieilloti* 111 or 111*a*
Wing-bars yellow, and belly pure white . . . . . *pennsylvanica* 124

A yellow spot in front of the eye and nowhere else . . . . . *nigrescens* 116
A white spot at base of primaries (almost never wanting) . . . . . *cærulescens* 117
Throat definitely yellow, belly white, back with no greenish . . . . . *dominica* or *graciæ* 129, 130, or 128
Rump, sides of breast, crown and throat, more or less yellow . . . . . *auduboni* 120
Bill extremely acute, perceptibly curved; rump (generally) yellow . . . . . *tigrina* 126
Rump, sides of breast, and crown more or less yellow; throat white . . . . . *coronata* 119
Wing-bars white, tail-spots oblique, at end of two outer feathers only . . . . . *pinus* 134
Tail-spots at middle of nearly all the feathers, rump and belly yellow . . . . . *maculosa* 125
Wing-bars brownish, tail-spots square, at end of two outer feathers only . . . . . *palmarum* 132, 133
Wing-bars not very conspicuous, whole under parts yellow, back with no greenish . . . . . *kirtlandi* 131
Tail-spots at end of nearly all the feathers, and no definite yellow anywhere . . . . . *cærulea* 118
Throat, breast, and sides black or with black traces, sides of head with diffuse yellow, outer tail-feather white-edged externally . . . . . *virens* and its western allies 112, 113, 114, 115
Throat yellow or orange, crown with at least a trace of a central yellow or orange spot, and outer tail-feather white-edged externally . . . . . *blackburnæ* 121
Bill ordinary; and with none of the foregoing special marks . . . . . *striata* or *castanea* 122 or 123

111. D. æsti'va. (Lat. *æstiva*, summery; *æstas*, summer.) SUMMER WARBLER. SUMMER YELLOW-BIRD. BLUE-EYED YELLOW WARBLER. GOLDEN WARBLER. ♂, adult: Golden-yellow; the back with a greenish tinge resulting in rich yellow-olive, the rump more yellowish; the middle of the back sometimes obsoletely streaked with darker. Crown like the under parts, in high plumage often tinged with orange-brown. Breast and sides, and sometimes most of the under parts, streaked with orange-brown. Quills and tail-feathers dusky, edged on both webs with yellow, the yellow occupying most of the inner webs of the tail-feathers. Bill plumbeous. Feet pale brown. Length 4.75–5.00; extent 7.50–7.75; wing 2.50; tail 2.00. ♀, adult: Yellow-olive of upper parts extending on the crown; streaks below obsolete or entirely wanting. General coloration paler. Young: Like the ♀, but still duller colored. Upper parts, including crown, pale olive, with an ochrey instead of clear yellow shade; below ochrey-white or dull pale yellowish. Edgings of wings and tail dull yellowish. North America, everywhere in woodland, gardens, orchards, parks, and even city streets, a beautiful, abundant, and familiar little bird. Nests throughout its range, in fruit or shade trees, shrubbery and brushwood, building a neat, compact, and durable nest of soft vegetable and animal substances felted together; eggs commonly 4–5, from 0.64 to 0.69 × 0.48 to 0.53, grayish- or greenish-white, variously dotted and blotched with reddish-brown and lilac shades. The color of this precious gem makes a pretty spot as it flits through the verdure of the forest or plays amidst the rose-tinted blossoms of the fruit-orchard; and its sprightly song is one of the most familiar sounds of bird-life during the season when the year renews its youth.

111a. D. vieil'loti bry'anti. (To L. P. Vieillot. To Dr. Henry Bryant.) CHESTNUT-HEADED GOLDEN WARBLER. Belonging to the "golden warbler" group of the genus, and resembling *D. æstiva* in general characters. Dusky predominating over yellow on the tail-feathers; tarsus about 0.72. ♂, adult: Whole head chestnut, well defined all around against the yellow; edging of wing-coverts slight; rufous streaks of breast and sides few and narrow. The continental *D. vieilloti*, as described by Cassin in 1860, would appear to be well distinguished among its immediate insular allies by the rufous hood which envelopes the head, but to be very questionably divisible into the several forms noted by Ridgway in 1874. That here given is described as the Mexican race, lately ascertained to occur at La Paz, Lower California. The ♀ is said to be indistinguishable from that of others of the golden warbler group. The extra-limital forms are all said to differ from the N. Am. *D. æstiva* in having longer tarsi and less yellow on the tail-feathers. (Not in the Check List, 1882. See Hist. N. A. Birds, i, 1874, p. 217, and Pr. U. S. Nat. Mus., iv, 1882, p. 414.)

112. D vir'ens. (Lat. *virens*, growing green. Fig. 160.) BLACK-THROATED GREEN WARBLER. ♂, in spring: Back and crown clear yellow-olive; forehead, superciliary line, and whole sides of head rich yellow (in very high plumage, middle of back with dusky marks, and dusky or dark olive lines through eyes and auriculars, and even bordering the crown); *chin, throat, and*

breast jet black, prolonged behind as streaks on the sides; other under parts white, usually yellow-tinged; wings and tail dusky, former with two white bars and much whitish edging, latter with outer feathers nearly all white; bill and feet blackish. ♂ in the fall, and ♀ in the spring: Similar, but the black restricted, interrupted, or veiled with yellow; *young* similar to the ♀, but the black still more restricted or wanting altogether, except a few streaks along sides. Small: Length 4.80–5.10; extent 7.60–8.00; wing 2.30–2.55; tail 2.00. Eastern U. S. and British Provinces, west only to the edge of the Plains; migratory, abundant; breeds from higher portions of the Middle States, and plentifully from New England northward; winters extralimital. This jaunty bird is one of the commonest warblers of summer in New England, breeding in the pineries, in June. Nest in fork of a bough, usually at some elevation, of the most miscellaneous materials; eggs 4–5, 0.67 × 0.54, white, with the usual sprinkling or wreathing of brown and purplish markings. The nuptial song is very peculiar.

113. D. occidenta'lis. (Lat. *occidentalis*, western; where the sun sets.) WESTERN WARBLER. HERMIT WARBLER. ♂, adult: Above, ashy-gray, tinged with olive, especially on the rump, and closely streaked with black; below, white. Top and sides of head rich yellow, the former with transverse black markings. Central line of chin, throat, and jugulum black, ending on the breast with a sharp convex outline, contrasted with the adjoining white. Wings and tail as in *virens*. Bill black. Length 4.75–5.00; extent 7.75; wing 2.50–2.75; tail 2.12–2.25; tarsus 0.66–0.75; bill 0.40. ♀, adult: Described as similar to the male, but darker gray above, with the yellow of the head less extended, and the throat whitish, spotted with dusky. Young: Upper parts olivaceous-ash, and the yellow of the top of the head overlaid with olive. Sides of the head pretty clear yellow, fading gradually into the white of the throat. No black on the throat. White of the under parts faintly brownish-tinged, and sides with obsolete streaks. In a September specimen the dusky olive extends over all the upper parts, tinging the ashy of the lower back, and reaching on the crown nearly to the bill, where it gradually lightens by admixture of yellow; the sides of the head are clear yellow, soiled with some olivaceous; chin and throat the same, fading on the breast into the dull white of the other under parts; sides with obsolete streaks, and a slight grayish-olive wash. There is no black whatever about the head or throat, and the blackish streaks of the back are obsolete. The wings are twice-barred with the conspicuous white tips of the greater and median wing-coverts. Rocky Mts. to the Pacific, U. S. and southward; one of the several western relatives of *D. virens*.

114. D. town'sendi. (To J. K. Townsend.) TOWNSEND'S WARBLER. ♂, adult: Entire upper parts yellowish-olive, rather darker than in *virens*, everywhere streaked with black, especially on the crown, where the black usually predominates; no hidden yellow on the crown. Side of the head bright yellow, enclosing a large black patch, constituted by the loral and orbital and auricular regions, in which the yellow eyelids appear. Chin, throat, breast, and sides part way, yellow, the jugulum black; the sides of the breast and of the body streaked with black. Under wing-coverts, belly, flanks, and crissum white, the two latter slightly shaded and streaked with dusky. Wings crossed with two white bands, that of the median coverts broadest. Wings and tail fuscous, the former with pale edgings, the latter having two or three outer feathers largely blotched with white. Bill and feet blackish horn-color. Length about 5.00; extent 7.50–8.00; wing 2.25–2.50; tail 2.00. ♀: Like the ♂, but the black of the jugulum mixed with yellow (and that on the sides of the head mixed with or replaced by olive?) Young: Shade of the upper parts slightly brownish, and the black streaks slight, obsolete, or wanting. The dark patch on the side of the head olivaceous, like the back. No continuous black on the jugulum. Autumnal adults show various gradations between the characters of the old and young. Very closely related to *D. virens*, of which it is the western representative. Adult males readily distinguished by the darker greenish upper parts, conspicuously streaked, especially on the head, with black; the black cheeks and auriculars;

black of jugulum not reaching anteriorly to the bill, and the surrounding yellow spreading on the breast back of the black. Young birds not so easily discriminated; but there are usually traces at least of the black streaks on the upper parts; there is no concealed yellow on the crown; the yellow of the under parts, quite as bright as in the adult, extends far along the breast, behind that part where it veils the black. Rocky Mts. to the Pacific, Alaska to Guatemala; common. A straggler taken at Philadelphia.

115. D. chrysopari'a. (Gr. *χρυσός, chrusos*, golden, and *παρειά, pareia*, cheek.) GOLDEN-CHEEKED WARBLER. Prevailing color of upper parts black, usually mixed with olive-green; sides of head yellow, with narrow black stripe through eye; below, with the wings and tail, as in *virens;* size of this species, and changes of plumage doubtless parallel; very closely related. ♂, in full dress: Above, jet-black from bill to tail, anteriorly narrowing to a point on the forehead, with scarcely a trace of olivaceous toward and on the rump. Entire side of head and neck golden-yellow, reaching the bill, elsewhere enclosed in black, and enclosing a long black stripe through eye to side of nape, nearly cutting off a superciliary stripe from the general yellow area, which, however, is continuous on lore and side of nape. Chin, throat, and breast jet black, this color extending backward along the sides as heavy streaking; narrowing anteriorly where sharply defined against the yellow; other under parts, including lining of wings, white, squarely defined against the black of breast (the whole under parts thus as in *virens*). Wings blackish, with two broad white cross-bars, and whitish edging of the quills, especially the inner secondaries. Tail blackish, the outermost feather white with only a black shaft-line clubbed at end; the next three pairs with decreasing white areas. Bill and feet black. Texas and southward; rare, at least in collections. Nest in upright fork, preferably of a cedar, large for the bird, compactly felted of bark strips, fine grasses, rootlets, and slender vegetable fibres and cobwebs, lined copiously with hair and feathers; eggs 0.75 × 0.55, white, dotted with reddish-brown and lavender, and blotched with darker brown, laid in May.

116. D. nigres'cens. (Lat. *nigrescens*, growing black. Fig. 164.) BLACK-THROATED GRAY WARBLER. ♂, adult: Above, bluish-ash, the interscapular region, and usually also the upper-tail coverts, streaked with black. Below, from the breast, pure white, the sides streaked with black. Entire head, with chin and throat, black; a sharply-defined yellow spot before the eye, a broad white stripe behind the eye, and a long white maxillary stripe widening behind from the corner of the bill to the side of the neck. Wings fuscous, with much whitish edging, and crossed with two broad white bars on the ends of the greater and median coverts. Tail like the wings, the three lateral feathers mostly white, except on the outer webs, the fourth with a white blotch. Bill and feet black. Size of *D. townsendi.* ♀: Like the male, but the black of the crown mixed with the ashy of the back, and that of the throat veiled with white tips of the feathers. Young: Like the ♀, but the crown almost entirely like the back, and the black of the throat still more hidden. Back not streaked. Less white on the tail. Bill not entirely black. Rocky Mts. to the Pacific, U. S. and southward, common in woodland. Quite unlike any other species; one of the five *Dendrœcæ* which are normally confined to the West.

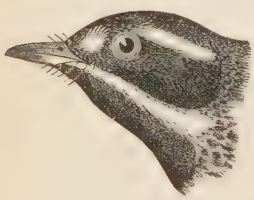

FIG. 164. — Black-throated Gray Warbler, nat. size. (Ad nat. del. E. C.)

117. D. cœrules'cens. (Lat. *cœrulescens*, growing blue; *cœruleus*, blue.) BLACK-THROATED BLUE WARBLER. ♂, in spring: Above, uniform slaty-blue, the perfect continuity of which is only interrupted in very high plumages, by a few black dorsal streaks; below, pure white; the sides of the head to above the eyes, the chin, throat, and whole sides of the body continuously jet black; *wing-bars wanting* (the coverts being black, edged with blue), *but a large white spot at base of primaries:* quill-feathers blackish, outwardly edged with bluish, the inner ones mostly white on their inner webs; tail with the ordinary white blotches, the central feathers edged with bluish; bill black; feet dark. Young ♂: Similar, but the blue glossed with

olivaceous, and the black interrupted and restricted. ♀ *entirely different:* Dull olive-greenish, with faint bluish shade, below pale soiled yellowish; but recognizable by the *white spot at base of primaries*, which, though it may be reduced to a mere speck, is nearly always evident, at least on pushing aside the primary coverts; no other wing-markings; tail-blotches small or obscure; feet rather pale. Size of *virens*. Eastern U. S., abundant, in woodland, its range closely coincident with that of *virens*. It is, however, rather a bird of brake and burn than of high woods, at least in summer; and nests in bushes, close to the ground. Eggs not peculiar. A beautiful bird, the ♂ with black, white and blue in masses, thus resembling no other, and the olive-colored ♀ as different as possible from her mate.

118. **D. cæru'lea**. (Lat. *cæruleus*, cerulean, sky-blue.) CERULEAN WARBLER. AZURE WARBLER. ♂, adult: Entire upper parts sky-blue, the middle of the back streaked with black; the crown usually richer and also with dark markings. Below, pure white, streaked across the breast and along the sides with dusky-blue — the breast-streaks inclining to form a short bar, sometimes interrupted in the middle. Auriculars dusky; edges of eyelids and superciliary line white. Wings blackish, much edged externally with the color of the back, the inner webs of all the quills, the outer webs of the inner secondaries, and two broad bars across the tips of the greater and median coverts, white. Tail black, with much exterior edging of the color of the back, all the feathers, except the middle pair, with small, white, subterminal spots on the inner webs. Length 4.00–4.50; wing 2.66; tail 2.00 or less. ♀, adult: Quite different. Upper parts dull greenish, with more or less grayish-blue shade, the greenish brightest and purest on the crown. Eyelids, line over eye, and entire under parts, whitish, more or less strongly overcast with dull greenish-yellow. Wings and tail dusky, the exterior edgings of the color of the back; the bars, spots, and interior edgings white, as in the ♂. The female is curiously similar to the same sex of *D. cærulescens*, but in the latter the tail-spots are different; there are no white wing-bars, but instead there is a small whitish spot at the base of the outer primaries. The autumnal plumage of the adults is said to differ in no wise from that of the spring. Young males are much like the adult females, but less uniformly greenish-blue above and purer white below, with evident blackish stripes on the interscapulars and sides of the head. The young female resembles the adult of that sex, but is still greener above, with little or no blue, and quite buffy-yellowish below. When in full dress this is a perfect little beauty, there being something peculiarly tasteful and artistic in the simple contrast of the snowy-white with the delicate azure-blue, without any "warm" color. Eastern U. S., rarely north to New England; west sometimes to the Rocky Mts. in the latitude of Colorado. One of the rarer species. Nest small and neat, in fork of a bough 20–50 feet from the ground; eggs 4, creamy-white, heavily blotched with reddish-brown, 0.60 × 0.47.

119. **D. corona'ta**. (Lat. *coronata*, crowned; *corona*, a crown. Fig. 165.) YELLOW-RUMPED WARBLER. YELLOW-CROWNED WARBLER. MYRTLE BIRD. ♂, in spring: Slaty-blue, streaked with black; below, white, breast and sides mostly black, belly, and especially throat, pure white, immaculate; *rump, central crown-patch, and sides of breast, sharply yellow*, there being thus *four* definite yellow places; sides of head black; eyelids and superciliary line white; ordinary white wing-bars and tail-blotches; bill and feet black. ♂ in winter, and ♀ in summer, similar, but slate-color less pure, or quite brownish; *young* birds are quite *brown* above, with a few obscure streaks in the whitish of the under parts. It is impossible to specify the endless intermediate styles; but I never saw a specimen without the yellow rump, and at least a trace of the other yellow marks; these points therefore are diagnostic. (The only other obscure-looking brownish warblers with yellow rump are *maculosa* and *tigrina*, when young. Resem-

FIG. 165. — Yellow-rumped Warbler, nat. size. (Ad nat. del. E. C.)

bles *auduboni*, excepting in the following points: — Throat white. Breast black, mixed with white. Sides of the head definitely pure black; edges of eyelids, and long narrow superciliary line, white. Wings crossed with two broad white bars, which do not fuse into one white patch, owing to narrowness or deficiency of white edging along the outer webs of the great coverts.) One of the larger species. Length 5.30–5.75; extent 8.80–9.40; wing 2.75–3.00; tail about 2.50. North America, but chiefly eastern; Alaska; Washington Territory; California; Arizona; U. S. rarely in summer, but during the migrations the most abundant of all the warblers; winters as far north as New England; seen everywhere, but is particularly numerous in shrubbery, along hedge-rows, in flocks, with troops of sparrows, titmice, etc. Breeds from northern New England northward; nest generally low in evergreens; eggs 4, about 0.75 × 0.55, with the usual markings. Moult double, there being a vernal as well as an autumnal change, the former usually effected during the spring migrations.

120. D. aud'uboni. (To J. J. Audubon.) AUDUBON'S WARBLER. WESTERN YELLOW-RUMP. ♂, *adult*, in summer: Upper parts clear bluish-ash, streaked with black. A central longitudinal spot on the crown, the rump, throat, and a patch on each side of the breast, rich yellow. Sides of the head little darker than the upper parts; eyelids narrowly white, but no decided superciliary white stripe. The ash of the upper parts extending far around the sides of the neck. Jugulum and breast in high plumage pure black, though usually mixed with some grayish skirting of the feathers, or invaded by white from behind, or even touched with yellow here and there. Belly and under tail-coverts white, the sides streaked with black. Wings blackish, with gray or white edging, especially on the inner quills; the median wing-coverts tipped, the greater ones edged and tipped, with white, forming a great white blotch. Tail like the wings, the outer webs narrowly edged with gray or white, the inner webs of all the lateral feathers with large white blotches. Bill and feet black. One of the largest species. Length, 5.50–5.75; extent, 8.75–9.33; wing, 2.75–3.00; tail, 2.25. ♀, in summer: Generally similar to the ♂. Upper parts duller and browner slate-color, with less heavy dorsal streaks; crown-spot and other yellow parts paler; breast not continuously black, but variegated with black, white, and the color of the back. Sides only obsoletely streaked. Eyelids scarcely white, and cheeks hardly different from the back. White of wing-coverts mostly restricted to two bars; white tail-spots smaller. Both sexes in autumn and winter, and young: Upper parts quite brown, with obscure black marking. Yellow crown-spot concealed or wanting; yellow of throat, rump, and sides of breast paler and restricted. Under parts whitish, shaded on the sides, and usually across the breast, with a dilute tint of the color of the back, the breast and sides obsoletely streaked with darker. White of wing-coverts obscured with brownish. North America, from easternmost woodland of the Rocky Mts. to the Pacific; north probably to Alaska; accidental in New England; migratory, breeding northward and in Alpine regions; extremely abundant; nesting in no wise peculiar.

121. D. black'burnæ. (To Mrs. Blackburn, an English lady.) BLACKBURN'S WARBLER. PROMETHEUS. ♂, adult, in spring: Entire upper parts, including the wings and tail, black, the back varied with whitish, the wings with a large white speculum on the coverts and much white edging of the coverts, the lateral tail-feathers largely white, only a shaft-line, with clubbed extremity, being left blackish on the outer two or three pairs. Spot on fore part of crown, eyelids, line over eye spreading into a large spot behind the auriculars, with chin, throat, and fore breast, intense orange or flame-color. There is nothing to compare with the exquisite hue of this Promethean torch. Sides of head black in an irregular patch, usually confluent with the black streaks on the side of the breast, isolating the orange of the sides of the head from that of the throat, and circumscribing the orange patch below the eye. Under parts from the breast white, more or less tinged with orange or yellow, and whole sides streaked with black. Bill and feet dark. Length about 5.50; extent 8.50; wing 2.75; tail 2.00. ♀, adult, in spring: Similar to the male in the pattern and distribution of the colors; upper

parts brownish-olive, streaked with black; the fiery orange of the male not so intense, or merely yellow, that on the crown obscure or obsolete. White speculum of the wing resolved into two white bars. Sides of the head like the back, instead of black as in the male, and the lateral streaks duller and more blended. ♂ and ♀, adult, in autumn, are sufficiently similar to the respective sexes in spring, but the coloration is toned down, the fiery colors of the male being less intense, and the black of the back being much mixed with olivaceous, bringing about a close resemblance to the spring female; while the female is duller still, and more impurely colored. Young: Early autumnal birds of the year of this species are very obscure-looking, showing no sign of the rich coloration of the adults. Above, like the adult ♀, but still browner, with more obsolete dusky streaking. Usually an indication of the crown-spot in a lightening of the part. Sides of the head like the crown, cutting off a superciliary stripe and the eyelids, which are ochrey-white. Whole under parts white, tinged, especially on the throat and breast, with yellowish, the sides with obsolete streaking. Indication of the peculiar pattern of the adults, though without their actual coloration, together with the extent of white on the tail-feathers, will usually suffice for the determination of the species, before any orange appears on the throat, after which there can be no difficulty. Chiefly Eastern N. Am.; W., however, to Utah. Abundant in mixed woodland; breeds in northerly parts of its U. S. range and northward; winters extralimital. One of the later migrants in spring. Nests in bushes and low trees; eggs not peculiar.

122. **D. stria'ta.** (Lat. *striata*, striped. Fig. 166.) BLACK-POLL WARBLER. ♂, adult: Back, rump, and upper tail-coverts grayish-olive, heavily streaked with black; whole crown pure glossy black. Below, pure white; a double series of black streaks starts from the extreme chin, and diverges to pass one on each side to the tail, the streaks being confluent anteriorly, discrete posteriorly. Side of head above the chain of streaks pure white, including lower eyelid. Wings dusky, the primaries with much greenish edging, the inner secondaries with whitish edging, the greater and median coverts tipped with white, forming two cross-bars. Tail like the wings, with rather small white spots at the ends of the inner webs of two or three outer feathers. Upper mandible brownish-black; lower mandible with the feet flesh-colored or yellowish. Length 5.25–5.75; extent 8.75–9.30; wing 2.70–2.90; tail 2.25. ♀: Entire upper parts, including the crown, greenish-olive, with dusky streaks; below, white, much tinged with greenish-yellow, especially anteriorly, the streaks dusky and not so sharp as those of the male, but still very evident. Bars and edgings of the wings greenish-white. Tail as in the male. Rather smaller than the male on an average. Young: Similar to the adult ♀, but brighter and more greenish-olive above, the streakings few and chiefly confined to the middle of the back; below, more or less completely tinged with greenish-yellow, the streakings obsolete, or entirely wanting. Under tail-coverts usually pure white. These autumnal birds bear an extraordinary resemblance to those of *D. castanea* (though the adults are so very different), the upper parts being, in fact, the same in both. But young *castanea* generally shows traces of the chestnut, or at least a buffy shade, quite different from the clear greenish-olive of *striata*, this tint being strongest on the flanks and under tail-coverts, just where *striata* is the most purely white. Moreover, *castanea* shows no streaks below, traces at least of which are usually observable in *striata*. N. Am., excepting the Western and most of the Middle Province; N. to the Arctic ocean, Greenland, Alaska; west to Nebraska and Colorado. Winters extralimital. Breeds from northern New England northward. Migrates late in the spring, bringing up the rear-guard of the Warbler hosts; when the Black-polls appear in force the collecting season is about over! Nests low in spruce-trees and other evergreens; eggs 5, 0.72 × 0.50, not peculiar.

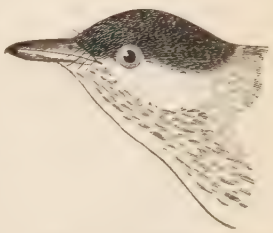

FIG. 166. — Black-poll Warbler, nat. size. (Ad nat. del. E.C.)

123. D. castan'nea. (Lat. *castanea*, a chestnut, in allusion to the color.) BAY-BREASTED WARBLER. ♂, in spring: Back thickly streaked with black and grayish-olive; *forehead and sides of head black, enclosing a large deep chestnut patch;* a duller chestnut (exactly like a blue-bird's breast) occupies the whole chin and throat and thence extends, more or less interrupted, along the entire sides of the body; rest of under parts ochrey or buffy whitish; a similar buffy area behind the ears; wing-bars and tail-spots ordinary; bill and feet blackish. ♀, in spring: More olivaceous than the male, with the markings less pronounced; but always shows evident *chestnut* coloration: and probably traces of it persist in all *adult* birds in the fall. The young, however, so closely resemble young *striata*, that it is sometimes impossible to distinguish them with certainty. The upper parts, in fact, are of precisely the same greenish-olive, with black streaks; but there is *generally* a difference below — *castanea* being there tinged with buffy or ochrey, instead of the clearer pale yellowish of *striata;* this shade is particularly observable on belly, flanks, and under tail-coverts, just where *striata* is whitest; and moreover, *castanea* is usually not streaked on the sides at all. Mature spring birds vary interminably in the extent and intensity of the chestnut. Size of *striata*. Eastern N. Am., north to Hudson's Bay, W. to the edge of the Plains. Winters extralimital. Migratory in most of the U. S. Breeds from northern New England northward. Nests moderately high in conifers, building a large nest of twigs, tree-moss, rootlets, fur, etc.; eggs 3–6, 0.70 × 0.52, *bluish-green*, profusely spotted with browns and lilac.

124. D. pennsylva'nica. (Of "Penn's woods"; *sylva*, a forest; *sylvanus*, sylvan. Fig. 167.) CHESTNUT-SIDED WARBLER. ♂, in spring: Back streaked with black and pale yellow (sometimes ashy or whitish); *whole crown pure yellow*, immediately bordered with white, then enclosed with black; sides of head and neck and whole under parts *pure white*, former with an irregular black crescent before the eye, one horn extending backward over the eye to border the yellow crown and be dissipated on the sides of the nape, the other reaching downward and backward to connect with a chain of pure chestnut streaks that run the whole length of the body, the under eyelid and auriculars being left white; wing-bands generally fused into one large patch, and, like the edging of the inner secondaries, much tinged with yellow; tail-spots white, as usual; bill blackish, feet brown. ♀, in spring: Quite similar; colors less pure; black loral crescent obscure or wanting; chestnut streaks thinner. Young: Above, including the crown, clear yellowish-green, perfectly uniform, or back with slight dusky touches; no distinct head-markings; below, *entirely white* from bill to tail, unmarked, or else showing a trace of chestnut streaks on the sides; *wing-bands* clear *yellow* as in the adult; this is a diagnostic feature, shared by no other species, taken in connection with the continuously white under parts; bill light-colored below. Small: Length 4.80–5.10; extent 7.75–8.10; wing 2.30–2.50; tail 2.00. Eastern U. S. and adjoining British Provinces; west only to the edge of the Plains; winters extralimital; breeds abundantly in Middle and Northern States; nests in forks of low saplings, shrubs, and bushes; eggs 4–5, 0.68 × 0.50, with the usual markings. A pretty species chained with chestnut on snowy ground.

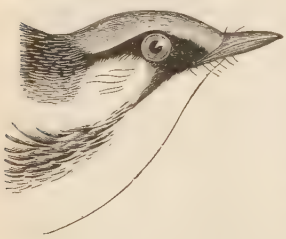

FIG. 167. — Chestnut-sided Warbler, nat. size. (Ad nat. del. E. C.)

125. D. maculo'sa. (Lat. *maculosa*, full of spots; *macula*, a spot. Fig. 168.) BLACK-AND-YELLOW WARBLER. MAGNOLIA. ♂ ♀, in spring: Back black, usually quite pure and uninterrupted in the ♂, more or less mixed with olive in the ♀; rump yellow; upper tail-coverts black, often skirted with olive or ashy. Whole crown of head *clear ash;* sides of head black, including a very narrow frontlet; the eyelids and a stripe behind the eye, between the ash and black, white. Entire under parts rich yellow, excepting the white crissum, heavily streaked with black across the breast and along the sides, the streaks on the breast so thick as to form a nearly continuous black border to the immaculate yellow throat. Wings fuscous, with white

lining, white edging of the inner webs of all the quills, of the outer webs of the inner secondaries, and with a large white patch formed by the tips of the median coverts and tips and outer edges of the greater coverts. Tail blackish, with *square* white spots on the middle of the inner webs of *all* the feathers excepting the middle pair. Bill blackish; feet dark. Length 4.75–5.00; extent 7.00–7.50; wing 2.25–2.50; tail 2.00–2.25. Young: Upper parts ashy-olive, grayer on head; rump as yellow as in the adult; no decided head-markings; a whitish ring around eye. Below, yellow, generally pure and continuous, sometimes partially replaced by gray; black streaks wanting, or few and confined to the sides. Wings with two bars; *tail-spots* as in the adult. While the sexes of this dainty little species are quite similar, the young require looking after; observe yellow rump, small square tail-spots on middle of feathers, and extensively or completely yellow under parts. Eastern N. Am., N. to Hudson's Bay and Great Slave Lake, W. to the Rocky Mts. of Colorado; abundant, chiefly migratory in the U. S.; winters extralimital; breeds from New England northward. Builds a small neat nest in low conifers; eggs 4–5, 0.64 × 0.48, not peculiar.

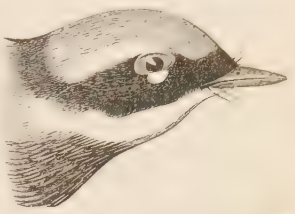

FIG. 168. — Black-and-yellow Warbler, nat. size. (Ad nat. del. E. C.)

126. D. tigri'na. (Lat. *tigrina*, striped like a tiger, *tigris*.) CAPE MAY WARBLER. Adult ♂, in spring: Back yellowish-olive, spotted with black; crown in high plumage perfectly black, usually interrupted with olive. Rump, sides of the neck nearly meeting across the nape, sides of head and entire under parts bright yellow; *ear-patch orange-brown;* a black transocular stripe, cutting off a yellow superciliary stripe; lower throat and whole breast and sides thickly streaked with black; yellow of throat sometimes tinged with orange-brown; that of belly and under tail-coverts pale or whitish. Wing-bars fused in a large white patch, formed by middle coverts and outer webs of most of the greater coverts. Quills and tail-feathers blackish, edged on outer webs with olive; tail-spots on three outer feathers near their ends, oblique, large on outer feather, diminishing on the next successively; bill and feet blackish. The yellow patch on the rump is conspicuous, and in high plumage that on the side of the neck is immaculate and very bright. ♀, in spring; Similar; lacking the distinctive head-markings; under parts paler and less streaked, tail-spots small or obscure; less white on the wing. Young: An insignificant-looking bird, resembling an overgrown ruby-crowned kinglet, without its crest; obscure greenish-olive above; rump yellowish; under parts yellowish-white; breast and sides with the streaks obscure or obsolete; little or no white on wings, which are edged with yellowish. Length 5.00–5.25; wing 2.75; tail 2.25. Eastern N. Am. to Hudson's Bay, only known W. to the Mississippi. Another exquisite, resembling the Magnolia in its yellow rump and yellow black-striped under parts, but easily recognized at maturity by the orange-brown ear-coverts; possessing also the charm of rarity in most parts. It is also remarkable for the curved and very acute bill, and some anatomical peculiarities of the tongue, which have caused it to be made type of a genus *Perissoglossa*. Breeds in portions of New England and northward; nest low in trees; eggs not peculiar.

127. D. dis'color. (Lat. *discolor*, parti-colored; opposed to *concolor*, whole-colored.) PRAIRIE WARBLER. Yellow-olive; back with a patch of *brick-red spots;* forehead, superciliary line, two wing-bars, and entire under parts, rich yellow; a V-shaped black mark on side of head, its upper arm running through eye, its lower arm connecting with a series of black streaks along the whole sides of the neck and body; tail-blotches very large, occupying most of the inner web of the outer feathers. The sexes are almost exactly alike, and the young only differ in not being so bright and in having the dorsal patch and head-markings obscure. Small: Length 4.75; extent 7.00–7.40; wing 2.15–2.25; tail 2.00. Eastern U. S. to Massachusetts; W. to Kansas; an abundant bird of the Middle and Southern States, in sparse low woodland, cedar thickets and old fields grown up to scrub-pines; remarkable for its quaint

and curious song; an expert fly-catcher, constantly darting into the air in pursuit of winged insects, like the Redstart and the species of *Myiodioctes*. Breeds throughout its U. S. range; winters in Florida and the West Indies. Nest on a bush or sapling near the ground; a small, neat, compact structure; eggs 3–6, not peculiar.

128. D. gra/ciæ. (To Miss Grace D. Coues, the author's sister.) GRACE'S WARBLER. Entire upper parts ashy-gray, with a slaty-blue tinge; the middle of the back streaked with black, the upper tail-coverts less conspicuously so marked; the crown with crowded black arrow-heads, especially anteriorly and laterally, the tendency of these markings being to form a line along the side of the crown, meeting its fellow on the forehead. A broad superciliary line of yellow, confluent with its fellow on the extreme front, changing to white behind the eye. Lores blackish; sides of head otherwise like the back, enclosing a crescentic yellow spot below the eye; edges of eyelids yellow. Chin, throat, and fore breast bright yellow, bordered with blackish streaks; the yellow of the throat separate from that under the eye or on the lores. Under parts from the breast white, the sides shaded with the color of the back, and streaked with black in continuation of the chain of shorter streaks along the side of the neck. Wings dusky, with very narrow whitish edging, and crossed with two white bars along the ends of the greater and median coverts. Tail like the wings; the lateral feather mostly white, excepting the outer web; the next two or three with white blotches, decreasing in size. Eyes, bill, and feet black; soles dirty yellowish. Length 4.90–5.25; extent about 8.00; wing 2.60; tail 2.25; bill under 0.50. ♂, in autumn: Color of the upper parts obscured with a shade of brownish-olive, the dorsal streaks obscure. The head-markings as in summer, and the yellow parts quite as bright. ♀: Quite similar to the male, and in fact scarcely distinguishable from the male in autumn, though the yellow is not quite so strong. Young: The slate-gray of the upper parts much shaded with brownish-olive, the black streaks wanting on the back, those on the crown obsolete. Yellow much as in the adult but paler, and not bordered along the sides of the neck with black streaks. The black lores are poorly defined. The wing-bars are grayish or obsolete. The white of the under parts has an ochrey tinge, and the lateral streaks are not so heavy in color nor so well defined. Southern Rocky Mt. Region of the U. S. and southward; a beautiful species, related to *dominica* and *adelaidæ;* it is abundant in the pine woods of Arizona and New Mexico. Nesting still unknown.

129. D. domin/ica. (Lat. *dominicus*, of St. Domingo.) YELLOW-THROATED WARBLER. Much like the last species, with which its changes of plumage correspond; back without black streaks; no yellow in the black under the eye. A white patch separating the black of the cheeks from the bluish-ash of the neck; a long superciliary stripe, usually yellow from bill to eye, thence white to the nape. Forehead and sides of crown usually quite black, chin and throat rich yellow, bordered on each side by black. Rest of under parts white, the sides boldly streaked with black. Bill black, extremely compressed, almost a little decurved, very long (at least 0.50). Length 5.00 or more; extent 8.00; wing 2.70; tail 2.25. A large handsome species, with its bright yellow throat. South Atlantic and Gulf States, common; N. sometimes to the Middle States, casually to New England. Breeds in its U. S. range at large; winters in Florida and extralimital.

130. D. d. albilo/ra. (Lat. *albus*, white; *lorum*, the lore.) WHITE-BROWED WARBLER. Precisely like the last; but superciliary stripe entirely white, and yellow of chin cut off from bill by white. This slight variety (considering how variable *dominica* is in amount of yellow in the superciliary line) is the common form of the Mississippi and Ohio valley, north regularly to Ohio, Indiana, Illinois, W. to Kansas and Texas.

131. D. kirt/landi. (To Dr. Jared P. Kirtland, of Ohio.) KIRTLAND'S WARBLER. ♂: Upper parts slaty-blue; crown and back streaked with black; lores and frontlet black; eyelids mostly white. Under parts clear yellow, whitening on crissum, the breast with small spots and the sides with short streaks of black; greater and middle wing-coverts, quills, and tail-

feathers edged with white; two outer tail-feathers white-blotched on inner web. Length 5.50; wing 2.80; tail 2.70. ♀, adult: Upper parts dull bluish-gray, obscured with brownish on the hind neck and back, marked with heavy blackish streaks on the whole back; crown and upper tail-coverts with fine black shaft-lines. Sides of head and neck like upper parts, with darkened lores and whitish eye-ring. Wing-quills dusky, with slight whitish edging of both webs; coverts like back, but with large blackish central field, and whitish edging and tipping, forming two inconspicuous wing-bars. Tail-feathers like wing-quills, only the outermost one having a small white blotch. Entire under parts dull yellow, brighter on breast, paler on throat and belly, washed with brownish on sides, with a slight necklace of brownish dots across the fore breast (as in *Myiodioctes canadensis*); these spots stronger on the sides of the breast, whence lengthening into streaks on the sides and flanks; a few small sharp scratches of the same nearly across lower breast. Under tail-coverts white, unmarked. Bill and feet black. Length about 5.30; wing 2.60; tail 2.30; bill 0.40; tarsus 0.80. Eastern U. S., the rarest of all the Warblers; only about a dozen specimens known thus far; its relationships appear to be with *dominica*, *graciæ*, and *adelaidæ*.

132. D. palma'rum. (Lat. *palmarum*, of the palms; gen. pl. of *palma*, a palm.) YELLOW RED-POLL WARBLER. PALM WARBLER. In spring: Brownish-olive, rump and upper tail-coverts brighter yellowish-olive, back obsoletely streaked with dusky, *crown chestnut;* superciliary line and entire under parts rich yellow, breast and sides with reddish-brown streaks, somewhat as in the Summer Warbler; a dusky loral line running through eye; *no white wing-bars*, the wing-coverts and inner quills being edged with yellowish-brown; tail spots *at very end* of inner webs of two outer pairs of tail-feathers only, and *cut squarely off* — a peculiarity distinguishing the species in any plumage. ♀ not particularly different from the ♂. Young: An obscure-looking object, brownish above like a young Yellow-rump, but upper tail-coverts yellowish-olive, and under tail-coverts apt to show quite bright yellow in contrast with the dingy yellowish-white or brownish-white of other under parts; pectoral and lateral streaks obscure; crown generally showing chestnut traces; but in any plumage, known by absence of white wing-bars and peculiarity of the tail-spots. Length 5.00–5.25; extent about 8.00; wing 2.50; tail 2.25; tarsus 0.75. Eastern N. Am., abundant; N. to Labrador, Hudson's Bay, Fort Resolution, etc.; breeds only beyond the U. S., excepting in Maine. Nest *on the ground;* peculiar in this respect in the genus, as far as known; eggs not peculiar. When the bird is migrating it is usually found in fields, along hedge-rows and road-sides, with Yellow-rumps and Sparrows; the most terrestrial species of the genus, often recalling a Titlark; migrates early in the spring, and remains in the fall latest of any, except the Yellow-rump, being observed at both these seasons in New England, with snow, in April and November; winters abundantly from the Carolinas to Texas, and in the West Indies.

133. D. p. hypochry'sea? (Gr. ὑπό, *hupo*, under; χρύσεος, *chruseos*, golden.) YELLOW-BELLIED RED-POLL WARBLER. Said to differ in being more brightly and continuously yellow on the under parts, with the streaks confined mostly to the sides, broadly tear-shaped instead of linear, reddish instead of dusky; lower eyelid yellow, not whitish; back brighter olive. "Atlantic States, from East Florida to Nova Scotia." According to this, *hypochrysea* should be the common bird of the Atlantic States, and what is above described as true *palmarum* should be the bird of the interior. But I have little faith in the validity of the physical characters assigned, and none in the geographical distinctions sought to be established.

134. D. pi'nus. (Lat. *pinus*, a pine.) PINE WARBLER. PINE-CREEPING WARBLER. ♂: Uniform yellowish-olive above, yellow below, paler or white on belly and under tail-coverts, shaded and sometimes obsoletely streaked with darker on the sides; superciliary line yellow; wing-bars *white;* tail-blotches *confined to two outer pairs of feathers, large, oblique.* ♀ and young: Similar, duller; sometimes merely olive-gray above and sordid whitish below, thus making very dingy, non-committal objects. The variations in precise shade are interminable; but the

species may always be known by the lack of any special sharp markings whatever, except the superciliary line; and by the combination of white wing-bars with large oblique tail-spots confined to the two outer pairs of feathers. One of the largest species, as well as most simply colored: length 5.50–5.75; extent 8.50–9.00; wing 2.75–3.00; tail 2.40; tarsus 0.70; bill 0.45. Eastern U. S., strictly; N. only to Canada and New Brunswick, W. only to the Mississippi Valley. Breeds throughout its whole range, and abounds in winter in the Southern States: is nearly resident, being sometimes seen in the Middle States in midwinter, and in New England early and late, with snow. Nests in pine-trees; nest and eggs not peculiar.

*** Thus passing in review the 23 "solid" species of *Dendrœca*, with two varieties lately introduced, I may allude to two species described by early authors, but never identified. 1. *Sylvia montana*, Wilson. This I have given (in the orig. ed., p. 105) some reasons for supposing to be a young *D. virens*. 2. *Sylvia carbonata*, Audubon. A strongly-marked bird, the like of which has never been seen since. It has been conjectured to be a hybrid of *D. tigrina* and *D. striata*.

40. **SIURUS**. (Gr. *σείω*, *seio*, I wave or brandish; *οὐρα*, *oura*, tail.) WAG-TAIL WARBLERS. In general form scarcely distinguishable from *Dendrœca;* larger in size, different in pattern of coloration, in habits, gait, and nidification. Bill ordinary. Rictal bristles short but evident. Wings pointed, much longer than tail. Tarsus longer than middle toe and claw. Tail nearly even, with rather acute feathers, and long, copious under coverts. Neither wings nor tail particolored. Above olivaceous, with or without head-markings, otherwise uniform; below white, buffy, or yellowish, profusely streaked. Legs slender, usually pale-colored. Habits terrestrial to some extent; nest on the ground; eggs white, spotted. Vocal powers preëminent. Gait ambulatorial, not saltatorial, and some other traits decidedly Motacilline.

Analysis of Species

Crown orange-brown, with two black stripes; no superciliary line . . . . . *auricapillus* 135
Crown like back; a long superciliary line.
Below, yellowish, heavily streaked; smaller; bill not over 0.50 . . . . . *nævius* 136
Below, whitish, lightly streaked; larger; bill over 0.50 . . . . . *motacilla* 138

135. **S. auricapillus**. (Lat. *aurum*, gold; *capillus*, hair. Fig. 169.) GOLDEN-CROWNED WAG-TAIL WARBLER. GOLDEN-CROWNED ACCENTOR. GOLDEN-CROWNED THRUSH. OVEN-BIRD. ♂ ♀, adult: Entire upper parts, including the wings and tail, uniform bright olive-green, without markings. Top of head with black lateral stripes, bounding a golden-brown or dull orange space. A white ring round eye; no white superciliary stripe. Under parts white, thickly spotted with dusky on the breast, the spots lengthening into streaks on the sides; a narrow black maxillary line; under wing-coverts tinged with yellow. Legs flesh-colored. Length 5.75–6.50, usually 6.00–6.25; extent 8.75–10.40, usually 9.50–10.00; wing 2.90–3.25; tail about 2.50. Varies much in size, but is remarkably constant in coloration with age, sex, and season; sexes indistinguishable, and young scarcely to be told from the adults. Fall specimens ordinarily quite as bright-colored as those of spring; and the orange-brown crown-spot, though it may be less bright, is acquired by the young with their first full feathering. There are at first no crown-stripes, and the lower parts are buffy, indistinctly streaked; upper parts fulvous-brown; wings and tail as in the adult. N. Am., W. to Colorado, Dakota, and Alaska: breeds throughout its N. Am. range; winters from the southern border southward. A pretty and engaging species, called "Oven-bird" from the way it has of roofing over its nest, abundant in woodland, migratory. In May the woods resound with its loud *crescendo* chant, so incessant and obtrusive that the bird was long in acquiring the reputation of musical ability

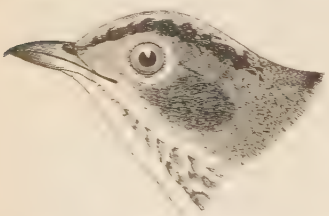

FIG. 169. — Oven-bird, nat. size. (Ad nat. del. E. C.)

to which its luxurious nuptial song entitles it not less than the Louisiana water thrush itself. The bird spends much of its time on the ground, trailing prettily among the fallen leaves with mincing steps. Nest on the ground, of leaves, grasses, etc.; eggs 4–6, white or slightly creamy, profusely speckled with reddish-brown and lilac, 0.85 × 0.65.

136. S. næ'vius. (Lat. *nævius*, spotted; *nævus*, a mole, birth-mark.) WAG-TAIL WARBLER AQUATIC ACCENTOR. NEW YORK WATER THRUSH. ♂ ♀: Uniform dark olive-brown; wings and tail similar, unmarked; below, pale sulphury-yellow, everywhere, except perhaps on the middle of the belly, thickly speckled or streaked with dark olive-brown, the markings smallest on the throat, largest on the sides. A long dull whitish superciliary line. Bill and feet dark. Length 5.50–6.00; extent 8.50–9.50; wing 2.75–3.00; tail 2.25; bill not over 0.50 along the culmen. The sexes do not differ appreciably. The shade of the upper parts varies from a decidedly olivaceous-brown to a purer, darker bistre-brown, and that of the under parts from sulphur-yellow to nearly white; but it is never of the buffy-white of *S. motacilla*. The streaking varies in amount and intensity, but has a sharp distinct character in comparison with *S. motacilla*, and is rarely if ever absent from the throat. No bill over 0.50, and this member lacks the peculiar shape, as well as size, characteristic of *S. motacilla*. The very young bird sooty-blackish, each feather of the upper parts with terminal bar of ochraceous; wing-coverts tipped with the same, forming two bars; streaks below as in the adult, but broader, and not so sharply defined. N. Am. at large, breeding in most if not all of its range; winters from the southern border southward; a common inhabitant of thickets, swamps, and morasses, less frequently of mixed woodland. Nest usually under a stump or log, of mosses, leaves, and grasses, lined with rootlets; eggs 4–6, brilliant white, profusely speckled, 0.80 × 0.60.

137. S. n. nota'bilis? (Lat. *notabilis*, noteworthy.) WYOMING WATER THRUSH. Described as identical in coloration with the last, but larger; wing 3.25; tail 2.50; bill from nostril 0.50; its depth at base 0.25; tarsus 0.83: middle toe without claw 0.56. Wyoming, one specimen: very doubtful.

138. S. motacil'la. (Lat. *motacilla*, a wag-tail. See p. 284.) LARGE-BILLED WAGTAIL WARBLER. LOUISIANA WATER THRUSH. Very similar to *S. nævius;* larger; length 6.00–6.25; extent 10.00–10.75; wing 3.00–3.25; bill especially longer and stouter, over 0.50; tarsus nearly 1.00. Under parts white, only faintly tinged, and chiefly on the flanks and crissum, with buff (not sulphury-yellow); the streaks sparse, pale, and not very sharp; throat, as well as belly and crissum, unmarked; legs pale. I have yet to see a specimen I cannot distinguish on sight; the size of the bill is by no means the only character, though it is a principal one. Eastern U. S., rather southern, and not very common; N. to Massachusetts regularly, sometimes to Maine; W. to Kansas, Indian Territory, and Texas; more abundant in the Mississippi Valley; breeds in its U. S. range at large; winters extralimital. Habits, nest and eggs like those of *S. nævius*. A sweet and skilful songster.

41. OPOROR'NIS. (Gr. ὀπώρα, *opora*, autumn; ὄρνις, *ornis*, a bird: noting the abundance of *O. agilis* in the fall.) BUSH WARBLERS. Bill of ordinary Sylvicoline characters. Rictal bristles short but evident. Wings pointed, much longer than tail; 1st quill nearly or quite longest. Tail nearly even, with acute feathers; wings and tail unmarked, like the back. Under tail-coverts long and copious. Tarsus about equal to middle toe and claw. Feet pale-colored; back, wings, and tail olive; under parts yellow; black or ashy on head. Sexes alike.

Analysis of Species.

Head without black; crown and throat ash; a whitish eye-ring	*agilis* 139
Head with black; line over eye and under parts yellow	*formosa* 140

139. O. a'gilis. (Lat. *agilis*, agile, active.) CONNECTICUT WARBLER. Olive-green, becoming ashy on the head; below, from the breast, yellow, olive-shaded on the sides; chin, throat, and breast dark ash; a whitish ring round eye; wings and tail unmarked, glossed with olive; under mandible and feet pale; no decided markings anywhere. Length about 5.50; extent

8.50–9.00; wing 2.75–3.00; tail 2.00. In spring birds the ash of the head and throat is quite pure, and very dark, almost black on the breast; then the resemblance to *Geothlypis philadelphia* is close; but in the latter the wings are little if any longer than the tail. In the fall the upper parts from bill to tail are nearly uniform olive, and the ash of the throat is pale. Eastern U. S., not commonly observed in the spring; abounding in the fall in some localities; a shy, fugitive inhabitant of brushwood and thickets. Distribution, migration, and breeding still imperfectly known.

140. O. formo'sa. (Lat. *formosa*, shapely, comely; hence, beautiful in any way. Fig. 170.) KENTUCKY WARBLER. Clear olive-green; entire under parts bright yellow, olive-shaded along sides; crown black, separated by a rich yellow superciliary line (which curls around the eye behind) from a broad black bar running from bill below eye and thence down the side of the neck; wings and tail unmarked, glossed with olive; feet flesh-color. Length 5.50–5.75; extent about 9.25; wing 2.75–3.00; tail 2.25. Young birds have the black obscure, if not wanting; in the fall, the black feathers of the crown of the adult are skirted with ash. Eastern U. S., N. to the Connecticut Valley; also known to occur near Quebec. Not abundant, but common in certain sections, as in Illinois, Kansas, and other portions of the Mississippi Valley. Breeds throughout its U. S. range; winters extralimital. A beautiful object, gleaming like gold in the tangle and débris of thick dark woods and swamps. Nest on the ground, or in rubbish near it, of leaves, grasses, weed-stems and rootlets, large and shallow; eggs 4–5, 0.70 × 0.56, crystal-white, sprinkled with reddish dots.

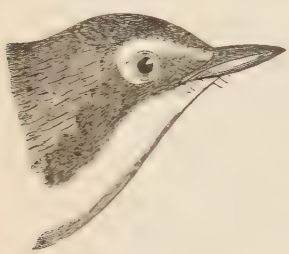

FIG. 170. — Kentucky Warbler, nat. size. (Ad nat. del E. C.)

42 GEOTHLYPIS. (Gr. γῆ or γέα, *ge* or *gea*, the earth, and θλυπίς or θραυπίς, *thlupis* or *thraupis*, name of some bird.) GROUND WARBLERS. Bill of ordinary Sylvicoline characters; rictal bristles very slight. Wings remarkably short and much rounded, scarcely or not longer than the rounded tail. Legs stout; tarsi longer than middle toe. Of medium and rather small size for this family. Coloration olivaceous above, with yellow below. Tail rounded, without white spots. Legs pale-colored. Habits somewhat terrestrial. Nest on the ground or near it. This genus affords several species more or less resembling the common Maryland Yellow-throat, chiefly of the warmer parts of America — three of N. Am. They are well distinguished from other Warblers by the extreme shortness of the wings, which are scarcely or not longer than the tail, and by the size of the pale-colored legs, which indicates somewhat terrestrial habits. Our species are familiar inhabitants of the shrubbery, ordinarily keeping near the ground, where the nest is usually placed.

Analysis of Species.

Sexes quite unlike: ♂ with a black mask bordered with ash, and throat yellow; ♀ with head plain . . . *trichas* 141
Sexes nearly alike: head and throat ashy, deepening on breast.
  No white eyelids; breast of adult ♂ quite blackish . . . . . *philadelphia* 142
  White eyelids; breast of adult ♂ scarcely different from throat . . . . . *macgillivrayi* 143

141. G. trich'as. (Gr. τριχάς, name of some bird in Aristotle. Fig. 171.) YELLOW-THROATED GROUND WARBLER. MARYLAND YELLOW-THROAT. ♂, in summer: Upper parts rich olive, inclining to grayish on the head, brightest on the rump. Wings and tail brown, edged with the color of the back. Chin, throat, and breast, with under wing- and tail-coverts, rich yellow. Middle under parts dull whitish, shaded on the sides. A broad black mask on the front and sides of the head, bordered behind by hoary-ash. Bill black; feet flesh-colored. Length 4.75–5.00; extent 6.50–6.90; wing 1.90–2.10; tail rather more. ♀, in summer: Rather smaller; yellow of the under parts paler and more restricted; no black or ashy markings on head, but crown usually with some concealed reddish-brown. Otherwise top and sides of head like back, with

some obscure whitishness about the lores and orbits. Young: Similar to the adult female, but the olive of the upper parts with much of a brownish tinge, the yellow parts and, in fact, most of the under parts, quite buffy. The adults, in fall and winter, are similar to each other, except in the purer and stronger yellow of the male, as at that season the peculiar black and ashy markings of the head are wanting. Both sexes then resemble the autumnal plumage of the young in the browner shade of the olive and buffiness of the under parts. U. S., from Atlantic to Pacific; breeds throughout this range; winters from the southern border southward. An abundant and familiar inhabitant of shrubbery and underbrush, the sameness of which is enlivened by its sprightly presence and hearty song throughout the summer months. Nest on the ground or near it, usually carefully concealed, of large size and built of any rubbish; eggs 4–6, usually 0.60–0.70 long by 0.50–0.55, white, rather sparingly sprinkled, and mostly at the large end, with several shades of brown: but the markings, like the size and shape of the eggs, are very variable.

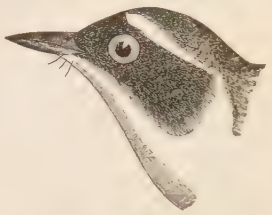

FIG. 171. — Maryland Yellow-throat, ♂, nat. size. (Ad nat. del. E. C.)

142. G. philadel'phia. (To the city of brotherly love; Gr. *φιλέω, phileo,* I love; *ἀδελφός, adelphos,* brother.) MOURNING WARBLER. ♂ ♀, in spring: Bright olive, below clear yellow; on the head the olive passes insensibly into ash; in high plumage of ♂ the throat and breast black; but generally ash, showing black traces, the feathers being black veiled with ash, producing a peculiar appearance suggestive of the bird's wearing crape; wings and tail unmarked, glossed with olive; under mandible and feet flesh-color; *no white about eyes* in adult ♂. Young, and generally fall specimens: Ash of the fore parts veiled with olive; sides and across breast quite olivaceous, leaving only central line of under parts yellow; blackish-ash of jugulum veiled by bright yellow tips of the feathers; eyelids brownish-yellow. Young birds have little or no ash on the head, and no black on the throat, thus resembling *Oporornis agilis;* but are of course distinguishable by their generic characters. Length 5.25–5.50; extent 7.50–8.00; wing and tail, each, about 2.25. Eastern U. S., W. to Kansas and Dakota, rare in most localities in the Atlantic States, but abundant in the Mississippi Valley; migratory; no record of wintering in the U. S.; breeds chiefly in the northernmost tier of States and along the British border. Nidification like that of *G. trichas;* eggs not distinguishable.

143. G. macgillivray'i. (To Wm. MacGillivray, the eminent Scotch ornithologist, co-author of Audubon's works.) MACGILLIVRAY'S WARBLER. ♂ ♀: Upper parts, including exposed surfaces of wings and tail, clear olive-green; below, bright yellow, shaded with olive on the sides. Head and neck all around, throat, and fore breast, clear ashy; *eyelids white;* the loral region usually dusky, the throat with blackish centres to the feathers, veiled by their gray skirting. Upper mandible blackish; under mandible and feet flesh-colored or pale yellowish. Length 5.25; extent 5.75–8.00; wing and tail, each, about 2.25. Seasonal and sexual differences those of *G. philadelphia,* of which it is the Western representative, differing in having white eyelids, and in never showing a decided black patch on the breast, which is conspicuous in the highly plumaged ♂ of the other form; but thus closely resembling ♀ *philadelphia,* which normally shows a whitish eye-ring, and has not the breast quite black. Middle and Western Provinces of the U. S., E. to the limit of trees on the plains, N. to British Columbia; abundant, migratory; breeds throughout its U. S. range; winters beyond. Nest and eggs as in others of the genus.

16. Subfamily ICTERIINÆ: Chats.

A small group, framed to accommodate the following genus and its two tropical allies, *Granatellus* and *Teretistris;* it is perhaps questionable whether they are most naturally classed with the Warblers.

43. **ICTERIA.** (Gr. ἴκτερος, *ikteros*, the jaundice: hence, yellowness; from the bird's golden breast.) CHATS. Bill stout, high at the base (higher than broad at nostrils), thence compressed; unnotched, unbristled, with much curved culmen and commissure. Frontal feathers reaching the nostrils, which are subcircular and scaled. Wings much rounded, shorter or not longer than the graduated tail. Tarsus partly booted, longer than middle toe: feet stout. Inner toe cleft to the degree usually seen in this family. Of largest size for this family. Form stout. Coloration simple, chiefly olive, yellow, and white. Sexes alike. Nest in bushes. Eggs white, spotted. Probably only one species.

144. **I. virens.** (Lat. *virens*, being green. Fig. 172.) YELLOW-BREASTED CHAT. ♂ ♀, adult: Bright olive-green, below golden-yellow, belly abruptly white: lore black, isolating the white under-eyelid from a white superciliary line above and a short white maxillary line below; wings and tail unmarked, glossed with olive: bill blue-black; feet plumbeous. Length about 7.50: extent about 10.00; wing about 3.00: tail about 3.25. Little difference with age, sex, or season in the plumage of this rich bird: very young have the fore under parts gray or white slashed with yellow, no black on lore, and lower mandible pale; white of belly and crissum tinged with buff. Eastern U. S., N. to Massachusetts, abundant, migratory; breeds throughout its range; an exclusive inhabitant of low tangled undergrowth, and oftener heard than seen, except during the mating season, when it performs the extravagant aërial evolutions for which, as well as for the variety and volubility of its song, it is noted. Nest in a crotch of a bush near the ground; eggs 3–4, very variable in size and markings, about 1.00 × 0.80, white, dotted, spotted or blotched with reddish-browns and the usual lilac shell-markings.

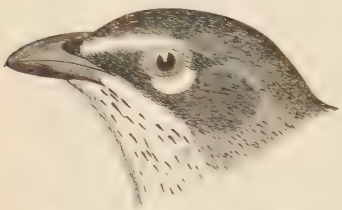

FIG. 172.—Yellow-breasted Chat, nat. size. (Ad nat. del. E. C.)

145. **I. v. longicau'da.** (Lat. *longus*, long: *cauda*, tail.) LONG-TAILED CHAT. ♂ ♀: Entire upper parts, including exposed surfaces of the wings and tail, grayish-olive. Quills of the wings and tail fuscous. Fore half of body below, including lining of the wings, rich yellow; hinder half white, shaded with gray on the sides. Loral region black: a sharp maxillary line, another from nostril over the eye, and the under eyelid, white. Bill blackish-plumbeous; feet plumbeous. Size of the last: tail averaging longer. Middle and Western Provinces of the U. S. This form, in its typical manifestation, differs from *virens* in the shade of the upper parts—quite grayish instead of pure olive-green: in the dullest-colored birds there is scarcely a tinge of olive in the gray of the upper parts. The yellow of the breast is as rich, however, as that of *virens*. As in the cases of so many birds from this region, the tail averages longer than that of Eastern representatives of the same species.

17. Subfamily SETOPHAGINÆ: Fly-catching Warblers.

These usually have the bill depressed, broader than high at base, notched and hooked at tip, and furnished with long stiff bristles that reach half-way or more from the nostrils to the end of the bill. In other respects they are not distinguished from the rest of the family. While many or most other *Sylvicolidæ* are expert in taking insects on the wing, these capture their prey in the air with special address, simulating in this respect the true Clamatorial flycatchers with which some species of *Setophaga* used to be classed in the extensive old genus "Muscicapa." It is hardly necessary to say that, however closely some of them may resemble the *Tyrannidæ*, they are at once distinguished from those Clamatorial birds by the Oscine character of the tarsi, and the presence of only nine primaries. The *Setophaginæ* are most developed in Central and South America, where they are represented by three or four genera, and upwards of forty species. They include some very brilliant little birds, with glossy black, orange, and even carmine red, very likely mistaken by heedless bugs for the tints of flowers. Besides the species

to be described, four or five others may be expected to occur over our Mexican border, — among them the lovely *Cardellina rubra*, which is carmine red all over, with silky white ears; *Setophaga miniata*, very near *S. picta;* and species of the genus *Basileuterus*. Our three genera are readily distinguished, so far as our species are concerned, by coloration.

Analysis of Genera.

♂ Black, white, and orange; ♀ brown, white, and yellow . . . . . *Setophaga* 46
♂ ♀ Ashy, white, and carmine or rosy red . . . . . *Cardellina* 45
♂ ♀ Without brown, red, or orange . . . . . *Myiodioctes* 44

44. MYIODIOC'TES. (Gr. *μυῖα, muia*, a fly, and *διώκτης, dioktes*, a pursuer.) FLY-CATCHING WARBLERS. Bill Muscicapine, though with lateral outlines a little concave, broad and depressed at base, with many obvious rictal bristles reaching decidedly beyond the nostrils; culmen and commissure nearly straight. Wings pointed, as in most *Sylvicolidæ*, longer than tail; 1st quill longer than 5th, 3d equalling or exceeding 4th. Tail narrow, even or little rounded. Middle toe without claw about three-fifths as long as tarsus. Tail unmarked, or with white blotches as in *Dendrœca*. No red or flame-color; always yellow below. Comprehends three species, well distinguished among *Sylvicolidæ* by the development of the rictal bristles and the depressed shape of the bill, though these Muscicapine characters are not pushed to the extreme seen in *Setophaga*. The tail is narrow, lacking the fan-shaped contour of that of *Setophaga*, and the feet are stouter, with longer toes. In *Cardellina*, a near ally, the bill is narrow and conoidal, somewhat Parine in appearance, with curved culmen. In *Basileuterus*, and in fact in all the extralimital forms of the Fly-catching Warblers, the wing is rounded, with the 1st quill shorter than the 5th.

Analysis of Species.

Olive and yellow; tail-feathers white-blotched . . . . . *mitratus* 146
Olive and yellow; tail-feathers plain . . . . . *pusillus* 147
Ashy-blue and yellow: tail-feathers plain . . . . . *canadensis* 149

146. M. mitra'tus. (Lat. *mitratus*, wearing a mitre, or other head-dress. Fig. 173.) HOODED FLY-CATCHING WARBLER. ♂, adult: Clear yellow-olive above; below, rich yellow, shaded with olive along the sides; whole head and neck pure black, enclosing a broad golden mask across forehead and through eyes; wings unmarked, glossed with olive; tail with large white blotches on the two or three outer pairs of feathers, as in *Dendrœca;* bill black; feet flesh-colored. Length 5.00–5.25; extent 8.50; wing about 2.75; tail about 2.25. ♀, adult, and young ♂, with the black restricted or interrupted, if not wholly wanting, as it is in the earlier stages, when the parts concerned are simply colored to correspond with the upper and under surfaces of the bird. Hood said to be not perfected till the third year, and to be finally acquired, in the fulness of its extent if not in the purity of the black, by the female. Eastern U. S., strictly; N. regularly to the Connecticut Valley; W. to Kansas; migratory; breeds at large in its U. S. range; winters extralimital. A lovely bird, reminding one of the Kentucky warbler, common in the south in such brakes and bottoms as the Kentucky haunts, rarer northward. Nest in bushes; eggs 4, about 0.70 × 0.50, as usual white, reddish-sprinkled.

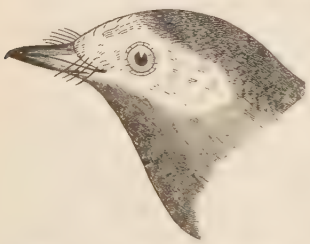

FIG. 173. — Hooded Warbler, nat. size. (Ad nat. del. E. C.)

147. M. pusil'lus. (Lat. *pusillus*, puerile, petty, small. Fig. 174.) BLACK-CAPPED FLY-CATCHING WARBLER. ♂, adult: Upper parts, including exposed edgings of the wings and tail, bright yellowish-olive: under parts, including front and sides of the head and superciliary line, rich yellow, shaded with olive on the sides. A

FIG. 174 — Black-capped Warbler, nat. size. (Ad nat. del. E. C.)

squarish, glossy blue-black patch on the crown. Wings and tail plain fuscous, with greenish edgings, unmarked with other color. Upper mandible dark; under mandible and feet light. Length 4.75; extent 6.75–7.00; wing 2.00–2.25; tail 2.00. ♀, and young: Lacking the black cap, the crown being colored like the back. There is very little variation in this species, according to age or season, though the adult summer birds are the more richly colored. N. Am. at large, in wooded regions; common, migratory. Breeds from the northernmost States northward to the limit of trees, and in the Rocky Mts. as far south as Colorado at least; winters extralimital. Nest on the ground; eggs 4–5, 0.60 × 0.50, white, speckled and blotched with dark reddish-brown and lilac.

148. M. p. pileola'tus. (Lat. *pileolatus*, wearing the *pileum*, a kind of cap.) WESTERN BLACK-CAPPED FLY-CATCHING WARBLER. Specimens from the Southern Rocky Mts. and Pacific coast region are frequently of a brighter yellow, almost orange, on the head and fore parts below, with the under mandible bright yellow.

149. M. canaden'sis. (Lat. of Canada. Fig. 175.) CANADIAN FLY-CATCHING WARBLER. ♂, adult in spring: Bluish-ash; crown speckled with lanceolate black marks, crowded and generally continuous on the forehead; the latter divided lengthwise by a slight yellow line; short superciliary line and edges of eyelids yellow; lores black, continuous with black under the eye, and this passing as a chain of black streaks down the side of the neck and prettily encircling the throat like a necklace of jet; excepting these streaks and the white under tail-coverts, the entire under parts are clear yellow; wings and tail unmarked; feet flesh-color. ♂ in autumn with the yellow very rich, even tipping the feathers of the black necklace. Length 5.25–5.50; extent 7.75–8.25; wing 2.50; tail 2.25. In the ♀ and young the black of crown, cheeks, and necklace is obscure or much restricted, and in the young the back may be glossed with olive; but they cannot be mistaken for any other species. Eastern N. Am., an abundant and beautiful woodland species, migratory, breeding from the Middle States occasionally, from New England regularly, northward to the limit of trees. Nest on the ground, in which respect species of this genus differ from most *Sylvicolidæ* and resemble *Helminthophila*; eggs 4-5, 0.75 × 0.55, white, dotted and blotched with reddish-brown after the usual fashion of warbler eggs.

FIG. 175. — Canadian Fly-catching Warbler. (Ad nat. del. E. C.)

45. CARDELLI'NA. (Apparently derived from Lat. *carduelis*, a kind of Finch; *carduus*, a thistle.) ROSE FLY-CATCHING WARBLERS. Bill Parine in shape, much shorter than head, high at base, culmen convex throughout; commissure curved. Rictal bristles stiff, but hardly reaching half-way from nostrils to tip of bill, which shows scarcely a trace of notch. Wings long and pointed; 2d, 3d, and 4th quills nearly equal and longest; 1st a little longer than 5th. Tail shorter than wings, nearly even. Feet small; tarsal scutella indistinct externally; tarsus longer than middle toe and claw.

150. C. ru'brifrons. (Lat. *ruber*, red; *frons*, front, forehead.) RED-FRONTED FLY-CATCHING WARBLER. ♂ ♀: Upper parts ash, wings and tail rather darker, edged with ashy-white; a broader and whiter bar across ends of median coverts. Below, from the breast, white, more or less shaded with ashy on the sides, and tinged with rosy. Rump and a nuchal patch white, or rosy-white. Whole head, throat, sides of the neck, and fore breast, bright red, with a broad black cap extending down on the sides of the head, involving the eyes and ears, ending in a point below the auriculars. The border of this cap is squarely transverse against the red of the forehead from eye to eye; behind it, the red reaches up the sides of neck, but not across the back of the neck, the white nuchal area there meeting the ashy of the back. Bill and feet dark. In the highest summer plumage, the red is rich and carmine in hue, the cap glossy-black; the under parts are much tinged with rosy; the rump is snowy-white. Less richly-

feathered specimens have the head plain red, the cap sooty-black. There is much difference in the character of the white on the nape. Length 5.00: wing 2.66; tail 2.50; tarsus 0.66; bill 0.33, quite different in shape from that of *Setophaga*. Young, newly fledged: Ash of upper parts much shaded with brown, and white of the under parts the same. Rump snowy-white, as in the adult, but the nuchal patch obscure or inappreciable. Wings and tail as in the adult, but with browner edgings. Black cap restricted to top of head, and of a dull sooty cast. Red parts of the adult, including those parts of the side of the head which are occupied in the adult with the extension of the black cap, dull grayish-brown, tinged or irregularly slashed with red, especially on the forehead and throat. Bill light brown; feet pale. Arizona, and doubtless New Mexico and Texas; common in the pineries of Southern Arizona.

46. SETO/PHAGA. (Gr. *σής, σητός, ses, setos,* an insect; *φάγω, phago,* I eat.) REDSTARTS. Bill thoroughly Muscicapine in depression and breadth at base, where wider than high, straightness of superior and lateral outlines, and development of rictal bristles, which reach far beyond the nostrils. Wings pointed, not shorter than tail; 2d, 3d, and 4th quills nearly equal and longest; 1st intermediate between 4th and 5th. Tail rather long and fan-shaped, with broad flat feathers, widening at their ends. Feet slender, with long tarsi indistinctly scutellate externally, and short toes, the middle one without its claw being about half as long as the tarsus. Coloration indeterminate. Habits arboricole and Muscicapine. The genus has been made to cover considerable variety in form among the numerous species of Fly-catching Warblers of subtropical and tropical America, where it is best represented. The diagnosis, drawn up from *S. ruticilla*, may require some little modification in order to its applicability even to *S. picta*. All the extralimital species differ in the shorter and more rounded wing and other characters. *S. ruticilla* is the only species in which the sexes are decidedly dissimilar in color; even in *S. picta*, the nearest ally, they are substantially alike; and in all the rest, in which the coloration is very various, there is no obvious difference between the sexes. Species of *Setophaga* (including *Myioborus* and *Euthlypis*), to the number of twelve or more, are recognized by late authors. *S. ruticilla* is the only one that is generally distributed in North America.

Analysis of Species.

♂ Black, white, and orange; ♀ brown, white, and yellow . . . . . *ruticilla* 152
♂ ♀ Black, white, and carmine-red . . . . . *picta* 151

151. S. pic'ta. (Lat. *picta*, painted. Fig. 176.) PAINTED FLY-CATCHING WARBLER. ♂ ♀: Lustrous black; middle of breast and belly carmine-red; eyelids, a large patch on the wings formed by the greater and middle coverts, broad edging of inner secondaries, edging of inner webs of primaries toward the base, lining of wings, nearly all the outer tail-feather, and a diminishing space on the next two or three, together with the crissum, white. Bill and feet black. Length 5 inches; wing and tail each 2.75; tarsus 0.66; bill 0.33–0.40. ♀ not particularly different from the ♂, though rather less richly colored. In poor plumages, the black is not so lustrous; red of the belly less extensive and of a more bricky-red tone; white of the wings and tail more restricted. Very young: Dull black, or only slightly lustrous; white nearly as in the adult; spot on lower eyelid, patch on wing, outer edge of first primary only, outer edges of secondaries, inside of wings, axillars, crissum, tibiæ, outer tail-feather except at base, and a diminishing space on the second and third, white. Arizona and N. Mexico, and doubtless also Texas; common in Santa Rita Mts. of Arizona. Nest found "under a projecting stone, in a bank near a stream"; large, flat, shallow, of bark, weed-fibre, grasses and a few hairs. Eggs 3, 0.65 × 0.50, white, speckled and wreathed with pale reddish-brown.

FIG. 176. — Painted Fly-catching Warbler. (Ad nat. del. H. W. Elliott.)

152. **S. ruticil'la.** (Lat. *ruticilla*, red-tail; *rutilus*, reddish; "redstart" is corrupted from *rothstert*, red-tail.) AMERICAN REDSTART. ♂, adult: Lustrous blue-black, the belly, flanks and crissum white. Sides of the body and lining of wings rich flame-color, which often tinges the breast quite across. Basal portions of all the wing-quills, excepting the innermost secondaries, the same rich reddish-orange, brightest on the outer webs, where it forms a conspicuous exposed spot, paler and more extensive on the inner webs. All the lateral tail-feathers similarly colored for half or more of their length, the orange meeting the black abruptly with transverse outline. Bill and feet black. Length 5.00–5.50; extent 7.50–8.00; wing 2.25–2.50; tail the same; bill 0.33; tarsus 0.66. ♀, adult: The black of the ♂ replaced on the upper parts with olive, growing more ashy on the head, on the wings with fuscous, and below with white. Sides rich yellow where the ♂ is orange, this color often tinging the breast across. Orange markings of the wings and tail of the ♂ replaced by clear yellow. Lores

FIG. 177. — Honey Creeper (*Certhiola flaveola;* not distinguishable in a cut from *C. bahamensis*), ⅔ nat. size. (From Brehm.)

dusky; eyelids and slight stripe from nostrils to eye whitish. Rather smaller than the ♂, about equal to the lesser several dimensions given. ♂, young: Like the ♀, but the upper parts more brownish, the tail quite black, and the yellow of the sides brighter. Males changing in the spring to their final plumage are irregularly patched with black in the general olivaceous and white. The spring migration includes males in this condition, and others irregularly patched with black, as well as those in perfect dress; whence it is evident that the redstart does not acquire his full-dress suit until in his third year. (See B. C. V., p. 340.) Temperate N. Am., but chiefly Eastern; W. to Utah. Breeds in most of its U. S., and all of its British American range; abundant from the Northern States. Nest a neat compact structure in the fork of a shrub or sapling at little elevation; eggs 4–5, averaging 0.65–0.50, not distinguishable from other warbler eggs. During the nuptial ecstasies the lovely redstart shines among the birds that throng the woodland, where his transparent beauty flashes like a lambent tongue of flame at play amidst the tender pale green foliage of the trees.

10. Family CŒREBIDÆ: Honey Creepers.

Primaries 9, and other external characters very nearly as in the last family: but the bill is generally slenderer and sharper, and often a little decurved. The line between the two families has never been drawn with precision, and has become more difficult of expression since some of the *Sylvicolidæ* have proven possessed of a peculiarity of the *Cœrebidæ:* deeply bifid, penicillate tongue. As commonly understood, it is a small group containing perhaps 40 species of pretty little birds, of the genera *Certhiola*, *Diglossa*, and *Cœreba*, confined to tropical and subtropical America, being especially numerous in the West Indies. Our species is merely a stray visitor to Florida.

47. **CERTHI'OLA.** (Diminutive of Lat. *certhia*, a creeper. Fig. 177.) HONEY CREEPERS. Bill little shorter than head, stout at base, but rapidly tapering to the extremely acute tip; whole bill much curved, culmen very convex, outline of under mandible continuously concave from base to tip. Rictus unbristled. Wings long, exceeding the short rounded tail. Tarsus longer than middle toe without claw. Contains about 15 species or varieties, mostly West Indian.

153. **C. bahamen'sis.** (Of the Bahamas.) BAHAMAN HONEY CREEPER. Dark brown above; long superciliary line and under parts dull white; breast, edge of wing, and rump, bright yellow; wings dusky, with a white spot at base of primaries, and whitish edging of the quills; tail dusky, tipped with white; bill and feet black; eyes blue. Length 4.50; wing 2.33; tail 1.75. Florida; Bahamas; closely related to the Stock species, *C. flaveola.*

11. Family TANAGRIDÆ: Tanagers.

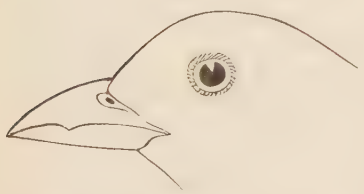

FIG. 178. — Dentirostral bill of a Tanager (*Pyranga hepatica*), nat. size.

An extensive, brilliant family, confined to America, abounding in species between the tropics. Its position is a point at issue with ornithologists; it may naturally follow the *Cœrebidæ* and *Sylvicolidæ*, though certainly no families should stand between it and *Fringillidæ*. In fact, certain tropical forms might be assigned to either indifferently. The best definition of the Tanagers is that given by the distinguished ornithologist who called them "dentirostral finches;" but this generalization, like other happy epigrams, is insusceptible of application in detail, and the Tanagers remain to be precisely characterized. As a consequence, the number of species can hardly be approximately estimated; but upwards of 300 are usually enumerated.

The single well-established North American genus may be recognized, among all the birds of our country, by the combination of nine primaries and scutellate tarsi with a turgid bill, notched at the tip and toothed or lobed near the middle of the maxillary tomia (fig. 178); though this last character is sometimes so obscure that it might be looked at without being seen. The species of *Pyranga* are birds of brilliant colors, with great seasonal and sexual differences of plumage. They are frugivorous and insectivorous, and consequently migratory in the United States. They inhabit woodland, lay 4–5 dark-colored, speckled eggs, nest in trees, and are no great songsters. In distribution they are rather southerly, scarcely passing northward beyond the U. S. One species of another genus, *Euphonia elegantissima*, admitted to our fauna upon insufficient evidence, doubtless occurs over the Mexican border.

48. **PYRAN'GA.** (Barbarous name of some South American bird.) SUMMER TANAGERS. Bill stout, turgid, conoidal, usually notched at tip, and with one or more denticulations of the cutting edge of upper mandible near middle of commissure. Rictal bristles well-developed. Nostrils basal, the frontal antiæ reaching them. Wings lengthened and pointed; first 4 feathers

subequal and longest. Tail moderate in length, shorter than wings, emarginate. Tarsus not longer than middle toe; lateral toes about equal, outer coherent with middle by nearly all of the length of its basal joint. Sexes more or less unlike in color; red usually prevailing in the male sex. Habits migratory, insectivorous, arboreal; voice not musical. Eggs spotted. Four species of this beautiful genus inhabit the U. S., three of them representing as many of the sections into which it is divisible according to pattern of coloration. Numerous others are found in the warmer parts of America.

Analysis of Species.

♂ Crimson or scarlet, with black wings and tail: ♀ clear olive and yellow. No wing-bars . . . *rubra* 154
♂ Vermilion or rose-red, including wings and tail; ♀ brownish-olive and buffy-yellow. Bill light.
Smaller: length about 7.50; wing 3.75 . . . . . *æstiva* 155
Larger: length about 8.00; wing 4.25 . . . . . *cooperi* 156
♂ Dusky-red above, including wings and tail. ♂ ashy-olive and yellow. Bill dark . . . . *hepatica* 157
♂ Yellow, with scarlet head and black back, wings and tail. ♀ clear olive and yellow, with 2 wing-bars *ludoviciana* 158

154. P. rub'ra. (Lat. *rubra*, red.) SCARLET TANAGER. ♂, adult: Crimson or scarlet; wings and tail black; bill and feet dark horn-color. ♀, adult: Above, clear olive-green; below, clear greenish-yellow; wings and tail dusky, glossed with the color of the back; no wing-bars. ♂, young: Like the ♀; later, when changing, patched with red, green, and black. Adult males often show abnormal coloring, the body being yellow, orange, or flame-color; or red patches appearing on the wing coverts. ♂ said to change back to plumage of ♀ at each fall moult (?) Length 6.75–7.00; extent 11.00–12.00; wing 3.50–3.90; tail about 3.00. Eastern U. S. and adjoining British Provinces, strictly; W. to Kansas, Indian Territory, and Texas; not common N. of Massachusetts; breeds throughout its U. S. range; winters extralimital. This brilliant creature nests in woods, groves, and orchards, upon the horizontal bough of a tree, building a rather loose and shallow fabric of twigs, fibres, rootlets, etc. Eggs 3–5, 0.95 × 0.65, dull greenish-blue, fully spotted with brown and lilac.

155. P. æsti'va. (Lat. *æstiva*, summery; *æstas*, summer.) ROSE TANAGER. SUMMER RED-BIRD. ♂, adult: Rich rose-red or vermilion, including wings and tail; the former dusky on unexposed portions of the feathers; bill pale; feet darker. ♀, adult: Dull brownish-olive above, below dull brownish-yellow; no wing-bars. ♂, young: Like the ♀. ♂ changing plumage shows red, greenish and yellowish in irregular patches, but no black. The ♀ distinguished from ♀ *rubra* by the dull brownish, ochrey, or buffy shades of the olive and yellowish, the greenish and yellowish of ♀ *rubra* being much clearer and paler; also by the paler bill and feet. The tint of mature males varies greatly; from rosy to bricky red. Size of *rubra*, or rather larger. Eastern U. S., strictly, and rather southerly; N. rarely to Connecticut, only casually farther; W. to Kansas, Indian Territory, and Texas. Migratory, abundant; breeds throughout its range; winters extralimital. Nesting and eggs like those of *rubra*.

156. P. a. coo'peri. (To Dr. J. G. Cooper, of California.) COOPER'S TANAGER. WESTERN SUMMER RED-BIRD. Characters of *æstiva;* back rather darker than head; larger; length about 8.00; extent about 13.00; wing 4.25; tail 3.60; bill 0.75; tarsus 0.80. Little distinguished. Southern Rocky Mt. region.

157. P. hepa'tica. (Lat. *hepar, hepatis*, the liver.) HEPATIC TANAGER. ♂, adult: Upper parts brownish-ashy, intimately mixed with dull red; top of head, upper tail-coverts, and edgings of wings and tail, brighter brownish-red. Inner webs and ends of wing-quills dusky; tail-feathers throughout decidedly tinged with red. Sides of the head like the back; edges of eyelids red. Below, bright red; sides and flanks shaded with the color of the back, many feathers often also with ashy skirting. Bill and feet blackish-plumbeous, the cutting edge of the upper mandible furnished with a tooth more prominent than in most species (fig. 178). Length about 8.00; wing 4.00; tail 3.33; bill 0.66; tarsus 0.80. ♀, adult: Bill and feet as in the ♂. Upper parts greenish-olive, with an ashy-gray tinge, the crown and rump clearer

and more yellowish-olive. Sides of head like back. Beneath yellow, clear and nearly pure medially, shaded on the sides with the color of the back, sometimes brightening almost into orange on the throat. Quills and tail fuscous, with olivaceous-yellow edgings, the former darker than the latter. Young ♂: Like the ♀; in males changing, the characters of the two sexes confused. Very young: There is an earlier *streaky* stage, before the assumption of a plumage like that of the ♀. Upper parts grayish-brown with an olive tinge; lower parts grayish-white with a yellowish shade; both everywhere streaked with dusky. Wings and tail like those of adult ♀, but the former with ochraceous bands across ends of greater and middle coverts. Southern Rocky Mt. region and southward.

158. **P. ludovicia/na.** (Lat. of Louisiana, formerly of great extent in the West; name now inapplicable.) CRIMSON-HEADED TANAGER. ♂, adult: Middle of back, wings, and tail, black; wings crossed by two yellow or yellowish-white bars on ends of greater and middle coverts; inner secondaries marked with white or yellowish. Head all around scarlet or even crimson, the color extending diluted on the breast. Other parts bright yellow, generally purest on the rump. Iris brown; bill horn-color; legs livid bluish. Length about 7.00; wing 3.50–4.00; tail 2.75–3.25; bill 0.60; tarsus 0.75. ♀, adult: Above, olive, darker and somewhat ashy-shaded on middle of back, clearer and brighter on rump and crown. Below, greenish-yellow, shaded with olive on sides. Wings and and tail fuscous, with edgings of the color of the upper parts; greater and median coverts tipped with white or yellowish; inner secondaries edged with the same. Averaging rather less than the ♂. The bird lacks the buffy shades characteristic of ♀ *æstiva*, besides being decidedly smaller. The general coloration, in its clear olive and yellow, is exactly that of ♀ *rubra*; from which distinguished by the white or yellow markings on the wings. The ♂ at first resembles the ♀, and in progress toward maturity every gradation between the two is presented. The distinctive dark dorsal area, and traces of the red of the head, soon appear. In a usual condition of incomplete dress, the black of the back is mixed with gray or olive, the yellow of the back of the neck is obscured, that of the under parts is shaded with olive, and the head is only partly red. Upper Missouri region and eastern foothills of the Rocky Mts. to the Pacific; British Columbia. Breeds in all its N. A. range and winters extralimital. Habits, nests, and eggs like those of our other Tanagers.

12. Family HIRUNDINIDÆ: Swallows.

FIG. 179. — European Barn Swallow, *Hirundo rustica*. (From Dixon.)

Swallows are fissirostral Oscine Passeres with nine primaries. Bill short, broad, flat, somewhat triangular, deeply cleft, the gape wide and about twice as long as the culmen, the mouth thus opening to about beneath the eyes. This is the strongest character of the family in comparison with its Oscine allies, and one perfectly distinctive, though some genera of Hirundines, especially *Progne*, approach the *Ampelidæ* in the form of the bill. The bill narrows rapidly to the compressed acute tip. Nasal fossæ short and wide; nostrils directed laterally or upward, sometimes circular and completely exposed, sometimes scaled over. Culmen convex, scarcely a third as long as the head; tip of upper mandible overhanging, usually nicked. Rictus smooth (or with a few inconspicuous bristles?). Wings extremely long and strong, the pinion bearing only 9 primaries, the 1st of which equals or exceeds the 2d in length, the rest being so rapidly graduated that the 9th

is scarcely or not half as long as the 1st; secondaries and their coverts also very short; all these quill-feathers broad and stout. An acute, thin-bladed and somewhat falcate wing, of surpassing volatorial power, results from these modifications. Tail of 12 rectrices, perhaps abnormally only 10, usually forked, or at least emarginate, and often deeply forficate, the outermost feathers being in this latter case narrowly linear in shape for a considerable distance. Feet short, small, and weak, ill-adapted to secure foot-hold, and very badly formed for walking. Swallows scarcely use their feet for locomotion, relying mainly upon their prowess of pinion. The tarsal envelope thoroughly Oscine in structure, being scutellate in front and laminate behind; it is sometimes partially, or almost entirely, feathered; the tarsi are commonly shorter than the lateral toes. The digits possess the normal number of phalanges; the basal phalanx of the middle digit is commonly coherent with one or both lateral toes; the hallux is ordinary, and not reversible. The digits are commonly naked and scutellate, rarely feathered to the claws. The claws are comparatively strong, compressed, well-curved, and acute, apt for clinging. The plumage is soft, smooth, and blended, most frequently glossy or even iridescent, but sometimes lustreless. Head short, broad, and depressed; neck short. Mouth capacious, its greatest width equalling that of the head.

FIG. 180. — Upper, European House Martin, *Chelidon urbica;* lower, Bank Swallow, *Cotile riparia.* (From Dixon.)

This is a perfectly natural group, well distinguished by the foregoing characters. The swallows alone represent, among Oscines, the fissirostral type of structure; they have a close superficial resemblance to the swifts and goat-suckers of another order, but the relation is one of analogy, not of affinity, though all these birds were formerly classed together in the highly unnatural "order" *Fissirostres.* (See beyond, under *Cypselidæ* and *Caprimulgidæ.*)

A hundred species of swallows are recorded; probably about three-fourths of them are genuine. They are distributed all over the world; the most generalized types, like *Hirundo* itself, are more or less cosmopolitan, but each of the great divisions of the globe has its peculiar subgenera or particular sets of species. Thus, all the American groups except *Hirundo* and *Cotile* are peculiar to this continent.

Swallows are insectivorous, and therefore migratory in cold and temperate latitudes; unsurpassed in powers of flight, they are enabled to pass with ease and swiftness from one country to another, as the state of the weather may require. With us a few warm days in February and March often allure them northward, only to be driven back again by the cold, giving rise to the well-known adage. No birds are better known to all classes than these, and none so welcome to man's abode, — cherished witnesses of peace and plenty in the homestead, dashing ornaments of the busy thoroughfare.

The habits of swallows best illustrate the modifying influences of civilization on indigenous birds. Formerly, they all bred on cliffs, in banks, in hollows of trees, and similar places, and many do so still. But most of our species have forsaken these primitive haunts to avail themselves of the convenient artificial nesting-places that man, intentionally or otherwise, provides. Some are just now in a transition state; thus the purple martin, in settled parts of the country, chooses the boxes everywhere provided for its accommodation, while in the West it retains its old custom of breeding in hollow trees. The nesting of our swallows now presents the following categories of method: —

1. Holes in the ground, dug by the bird itself, slightly furnished with soft material: *Cotile riparia*, *Stelgidopteryx serripennis*.

2. Holes in trees or rocks not made by the birds, fairly furnished with soft material: *Progne subis*, *Iridoprocne bicolor*, *Tachycineta thalassina*.

3. Holes, or their equivalents, not made by the birds, but secured through human agency, and more or less fully furnished with soft material, according to the shallowness or depth of the retreat. (*Formerly, no species; now, all the species excepting Cotile riparia.*)

4. Holes constructed by the birds, of mud, plastered to surfaces, whether artificial or natural, and loosely furnished with soft material. This is seen in perfection in the nesting of *Petrochelidon lunifrons*, and is imperfectly illustrated by the nidification of *Hirundo horreorum*.

5. Eggs pure white, unmarked: *Iridoprocne bicolor*, *Tachycineta thalassina*, *Cotile riparia*, *Stelgidopteryx serripennis*, *Progne subis*.

6. Eggs thickly speckled: *Hirundo horreorum*, *Petrochelidon lunifrons*.

The seven established North American species, referable to as many modern genera, may readily be determined by the following

Analysis of Genera and Species.

1. Tail deeply forficate, with linear lateral feathers; lustrous steel-blue above, rufous below *Hirundo erythrogastra horreorum* 159
2. Tail simply emarginate; lustrous green; beneath white . . . . . *Iridoprocne bicolor* 160
3. Tail simply emarginate; opaque velvety-green; beneath white . . . . . *Tachycineta thalassina* 161
4. Tail nearly even; lustrous steel-blue; rump rufous . . . . . *Petrochelidon lunifrons* 162
5. Tarsus with tuft of feathers below; lustreless gray; below white . . . . . *Cotile riparia* 163
6. Outer edge of first primary serrate; lustreless brownish; paler below . . . *Stelgidopteryx serripennis* 164
7. Bill very stout, curved; male entirely lustrous blue-black . . . . . *Progne subis* 165

49. HIRUN'DO. (Lat. *hirundo*, a swallow. Figs. 179, 181.) BARN SWALLOWS. Tail deeply forficate, nearly or about as long as the wings; lateral feather linear-attenuate, about twice as long as the middle feather. Tarsi shorter than middle toe and claw, above feathered for a little distance; basal joint of middle toe partly adherent to both lateral toes. Bill of moderate size for this family, of the usual shape, with straight commissure; nostrils lateral, overarched by a membranous scale. Upper parts glossy, dark-colored; a dark pectoral collar; forehead and under parts rufous; tail spotted with white. Eggs colored. Sexes similar.

159. H. erythrogas'tra horreo'rum. (Gr. *ἐρυθρός, eruthros,* ruddy, and *γαστήρ, gaster,* belly. Lat. *horreorum,* of barns, gen. pl. of *horreum,* a barn.) BARN SWALLOW. ♂, adult: deep lustrous steel-blue; forehead and entire under parts rufous, generally deepest on the forehead and throat; an imperfect steel-blue collar. Wings and tail blackish, with steel-blue or somewhat greenish gloss; the lateral pair of tail-feathers much lengthened and filiform at the end, all but the central pair with a white spot. Length 6.00–7.00, very variable, according to the development of the tail; extent 12.50–13.50; wing 4.50–5.00; tail 3.00–5.00, the fork 2.00–3.00 deep. ♀, adult: Quite like the ♂; colors rather less intense and lustrous; average size smaller. Young: Lacking in great measure the elongation and attenuation of the lateral tail-feathers, the fork being an inch or less in depth. Similar to the adults, but much duller, and with rather a greenish than steel-blue lustre — at an early age quite brown, with scarcely any lustre, and the rump and upper tail-coverts skirted with rusty. Frontlet obscurely marked or reduced to a mere tawny line, and under parts, especially behind the dark collar, very pale, even brownish-white. N. Am. at large; abundant; breeds throughout its range.

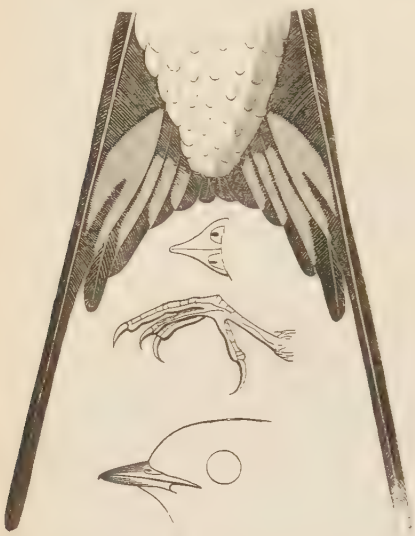

FIG. 181. — Generic details of *Hirundo* (*H. horreorum*, nat. size). (Ad nat. del. E. C.)

50. IRIDOPROC'NE. (Gr. *Ἶρις*, gen. *Ἴριδος*, Iris, messenger of the gods; also the rainbow; *Πρόκνη*, Procne, daughter of Pandion.) IRIS SWALLOWS. Plumage compact, lustrous, as in *Hirundo;* but tail lacking the elongation of that genus, being simply emarginate. Under parts snowy white. Eggs colorless. Sexes similar.

160. I. bi'color. (Lat. *bicolor*, two-colored. Fig. 182.) WHITE-BELLIED SWALLOW. ♂, adult: Entire upper parts glossy dark green; wings and tail blackish, lustrous; lores black. Entire under parts pure white. Bill black; feet dark. Length about 6.00; extent 13.00; wing 4.50–5.00; tail 2.50. ♀: Similar, the colors rather less intense and lustrous. Young: Birds of the year slowly acquire a plumage differing only in the less lustre and intensity from that of the adults; but, on leaving the nest, they are dark mouse-gray or slate-color above, including the wings and tail, the interscapulars and inner quills tipped with rusty; and white below, slightly shaded with ashy; thus curiously similar to *Cotile riparia.* The feet yellow. The first plumage is worn longer than usual, the autumnal dress being slowly gained — one or two of the metallic-tinted feathers at a time. The quills of the wing are moulted by the young as well as by the adult, and in both, in autumn, the inner secondaries are white-tipped. Temperate N. Am. Breeds indifferently in all parts of its range, and winters abundantly on the southern border.

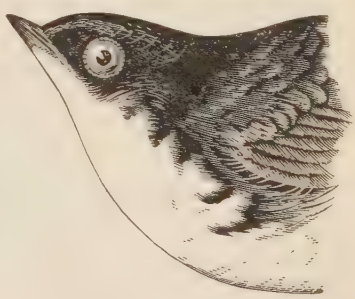

FIG. 182. — White-bellied Swallow, nat. size. (Ad nat. del. E. C.)

51. TACHYCINE'TA. (Gr. *ταχυκίνητος, tachukinetos,* moving rapidly.) VIOLET-VELVET SWALLOWS. Similar to the last, but lacking lustre of the richly varied plumage of the upper parts.

161. T. thalas'sina. (Gr. *θαλάσσιος, thalassinos*, sea-green.) VIOLET-GREEN SWALLOW. ♂, adult: Entire under parts, including the sides of the head to just above the eyes, and an enlarged fluffy tuft on the flanks tending to join its fellow over the rump, pure silky white. Upper parts rich, soft, velvety-green, mixed with a little violet-purple; the crown of the head similar, but rather greenish-brown, with a purplish tinge. Cervical region, in some cases a well-defined though narrow cervical collar, and the upper tail-coverts, violet-purple. These rich colors opaque, without gloss or sheen; wings and tail blackish, with violet and purplish gloss. Bill black; feet brownish-black, small; iris brown; mouth pale yellow. Length 4.50–5.00; extent 11.50–12.50; wing 4.50; tail 2.00, lightly forked; bill 0.25; tarsus 0.40. The ♀, and immature birds in general, differ simply in the less purity and intensity of the colors of the upper parts. In the very highest plumaged specimens, the back is nearly pure green, the cervical collar distinct, and the several contrasts of crown, collar, back, and upper tail-coverts are strong; in general, the back has a brownish-purple shade, more like that of the crown. Very young birds are like *I. bicolor*, though smaller, being dark mouse-gray above and white below. But traces at least of the special tints speedily appear. Young or autumnal birds usually have the inner secondaries white-tipped, as in *I. bicolor*. Middle and Western Provinces, U. S. and adjoining portions of British America; E. to the Upper Missouri. Breeds throughout its range, and winters extralimital. A lovely species.

52. PETROCHELI'DON. (Gr. *πέτρα. petra*, a rock; *χελιδών, chelidon*, a swallow.) CLIFF SWALLOWS. Bill stout and deep (for this family); nostrils superior, opening without nasal scale. Tail unusually short, the tips of the folded wings reaching beyond it, about even, or only slightly emarginate, with the feathers broad to their ends. Feet much as in *Hirundo;* tarsi feathered above; toes extensively adherent at base. A bristly appearance of the front and chin, different from what is seen in other groups. The tuft of crissal feathers is full, reaching nearly to the end of the tail. The species agree well in a special pattern of coloration, being steel-blue above, with rufous rump and nuchal band, and usually a frontlet of different color from the rest of the upper parts; under parts not continuously white as in *Tachycineta* and *Iridoprocne*. The nidification peculiar; eggs colored. Sexes alike.

162. P. lu'nifrons. (Lat. *luna*, the moon, or a crescent; *frons*, forehead. Fig. 183.) CLIFF SWALLOW. EAVES SWALLOW. CRESCENT SWALLOW. MUD SWALLOW. ♂♀, adult: Back and top of head, with a spot on the throat, deep lustrous steel-blue, that of the crown and back separated by a grayish nuchal collar. Frontlet white or brownish-white. Shorter upper tail-coverts rufous. Chin, throat, and sides of head intense rufous, sometimes purplish-chestnut, prolonged around the side of the nape. Under parts dull grayish-brown, with usually a rufous tinge (rusty-gray), and dusky shaft-lines, whitening on the belly, the under tail-coverts gray, whitish-edged and tinged with rufous. Wings and tail blackish, with slight gloss. Bill black; feet brown. Length 5.00–5.50; extent 12.00 or more; wing 4.25–4.50; tail 2.25, nearly square. Sexes not distinguishable; both vary much in the tone of coloration, especially of the rufous parts. Forehead sometimes white, sometimes quite brown. In young birds, the frontlet may be altogether wanting; upper parts lustreless dark brown, most of the feathers being skirted with whitish; the rufous of the throat and rump a mere tinge, the spot on the throat wanting, and the parts often speckled with white. N. Am. at large, abundantly but irregularly distributed, breeding in colonies wherever suitable sites may be found for its curious retort-shaped or bottle-nosed nests of mud.

FIG. 183. — Cliff Swallow, nat. size. (Ad nat. del. E. C.)

53. CO'TILE. (Gr. *κωτιλάς. kotilas*, a babbler, twitterer.) BANK SWALLOWS. Tarsus with a tuft of feathers at the base below, near insertion of the hind toe. Edge of wing not rough.

Claws little curved, the lateral reaching beyond the base of the middle one. Bill very small, the nostrils opening laterally and overhung by a membrane. Tail much shorter than wings, emarginate. Coloration dull and simple — lustreless brown above and across breast, white below. Eggs uncolored, laid in holes in the ground excavated by the bird. Sexes alike.

163. C. ripa'ria. (Lat. *riparia*, riparian; *ripa*, bank of a stream. Figs. 180, 184.) BANK SWALLOW. ♂ ♀: Lustreless mouse-brown; wings and tail fuscous. Below, white, with a broad pectoral band of the color of the back. A dusky ante-orbital spot. Length about 5.00; extent 10.50; wing 4.00; tail 2.00. Sexes similar; the young differ chiefly in whitish edgings of the feathers, especially of the wings and tail. Even in the adult, the upper parts are apt to be not quite uniform, there being paler gray edgings of most of the feathers. The dark pectoral band sometimes extends backward along the middle of the under parts (not shown in fig. 184). Autumnal specimens have the secondaries white-tipped. Very young birds have rather rusty than whitish skirting of the dark feathers, and the white throat speckled with the same. Almost cosmopolitan: Europe, Asia, Africa, America; abundant in N. Am., breeding in immense troops in holes in the ground, wherever suitable sites offer, as natural embankments, rail-road cuttings, gravel-pits, etc.

FIG. 184. — Bank Swallow. (Designed by H. W. Elliott.)

54. STELGIDO'PTERYX. (Gr. στελγίς, *stelgis*, a scraper; πτέρυξ, *pterux*, wing.) ROUGH-WINGED SWALLOWS. General aspect of *Cotile;* form and coloration much the same. Outer web of 1st primary converted into a series of stiff, recurved hooks. (Other Swallows, as *Psalidoprocne* Cab., have this peculiar wing structure, but are otherwise different.) The design of the structure is not clear, but we may readily suppose that the hooks assist the birds in crawling into their holes, and in clinging to vertical or hanging surfaces. Tarsus slightly feathered above, but lacking the curious tuft seen at the base of the hind toe in *Cotile*. Lateral claws curved, and not reaching beyond the base of the middle. Basal joint of middle toe extensively adherent to the outer, much less so to the inner. Bill small, with oval, superior nostrils margined by membrane behind, but not overhung. Tail short and slightly emarginate. Eggs uncolored, in holes dug by the birds, or elsewhere. Sexes alike.

164. S. serripen'nis. (Lat. *serra*, a saw; *penna*, a feather.) ROUGH-WINGED SWALLOW. ♂ ♀: Lustreless mouse-brown or brownish-gray, paler below, gradually whitening posteriorly. Wings and tail darker than the upper parts. Rather larger than the last species. No dark pectoral band contrasting with white. No tuft of feathers at the base of the hind toe. Young: At a very early age, the feathers of the back, rump, and wings are suffused or edged with rich rusty-brown, while the under parts are more or less tinged with a paler shade of the same. The hooklets of the wings are only fully developed in adult birds, and are not appreciable at all in young ones. U. S. and adjoining British Provinces; rare in Eastern States.

55. **PROG'NE.** (Gr. Πρόκνη, *Procne*, a mythological character.) Of large size and robust form for this family. Bill long and stout, with much-curved commissure and deflected tip; culmen convex, its tomial edge concavo-convex like ∽. Nostrils circular, opening upward, without nasal scale. Feet large, with strong, much-curved claws; tarsus shorter than middle toe and claw; lateral toes about equalling each other in length; basal joint of middle toe freer from lateral toes than usual. Tail forked. Sexes dissimilar. Eggs colorless.

165. **P. subis.** (Lat. *subis*, name of an unknown bird.) PURPLE MARTIN. ♂, adult: Intense lustrous steel-blue. Wings and tail blackish, with bluish lustre. Bill black; feet blackish. Length 7.50 inches; extent 15.50; wing 5.50–6.00; tail 3.00–3.50, forked; bill 0.50, very stout, broad at the base, somewhat decurved at the end; nostrils circular, exposed, opening upward. ♀: Dark grayish-brown, glossed on the back and head with steel-blue. Wings and tail fuscous, paler on the inner webs, with narrow gray edgings. Beneath, whitish, shaded with dark gray in most parts, the feathers very generally with dusky shaft-line. Young birds of both sexes resemble the adult female, though the young males are rather darker. The steel-blue appears at first in patches. U. S. and adjoining British Provinces, abundant and generally distributed; breeds throughout its range, usually in the East in boxes provided for its accommodation, in the West in holes in trees.

13. Family AMPELIDÆ: Chatterers.

This appears to be an arbitrary and unnatural association of a few genera that agree in some particulars, but are widely different in others. The composition and position of the group differ with almost every writer; some place it in *Clamatores*, next to the *Tyrannidæ*. I think that the family should be dismembered; the *Myiadestinæ* are near the true Thrushes, and doubtless the other two subfamilies here presented may be properly dissociated.

Birds of the three following genera agree in this character: Bill short, broad, flattened, plainly notched at tip, with wide rictus, and culmen or gonys hardly or not exceeding half the length of the commissure; basal phalanx of middle toe joined with outer toe for about two-thirds its length, and to inner toe for about half its length. The three, considered separately, may be readily and precisely defined.

18. Subfamily AMPELINÆ: Waxwings.

Of this subfamily, as here restricted, there is only one genus with three species — one of Europe, Asia, and America, one of Asia and Japan, one peculiar to America.

56. **AM'PELIS.** (Gr. ἀμπελίς, Lat. *ampelis*, name of a bird.) WAXWINGS. Bill short, broad, flat, rather obtuse, plainly notched near tip of each mandible, with wide and deeply-cleft gape, the convex culmen and gonys less than half as long as the nearly straight commissure, the width of rictus more than two-thirds the length of the gape. Nasal fossæ broad, but filled with short, erect or antrorse, and close-set velvety feathers; nostrils narrowly elliptical, overarched by a (feathered) scale. Rictal vibrissæ few and short. Wings long and pointed, much longer than the tail, their point formed by the 3d primary, closely supported by the 2d and 4th, the 5th abruptly shorter and the rest rapidly graduated. Primaries 10, but the 1st spurious, so very short as readily to escape observation, and sometimes displaced to the outer side of the 2d primary, — a condition like that seen among the Vireos. Inner quills, as a rule, and sometimes the tail-feathers, tipped with curious red horny appendages, like sealing-wax. Tail short, narrow, even, two-thirds or less of the length of the wing. Feet rather weak; tarsus shorter than the middle toe and claw, distinctly scutellate with five or six divisions anteriorly and somewhat receding from strict Oscine character by subdivision of the lateral plates. Lateral toes of nearly equal lengths, the ends of their claws scarcely reaching the base of the middle claw; hallux about as long as the inner lateral toe. Basal phalanx of middle toe coherent with outer

toe for about two-thirds its length, with inner toe for about half its length. Body stout. Head conspicuously crested. Plumage peculiarly soft, smooth, and silky. Tail tipped with yellow (or red, in the Japanese *A. phœnicoptera*). Sexes alike; young different. Eggs spotted. Nest on trees.

166. A. gar'rulus. (Lat. *garrulus*, a jay-bird: from its loquacity. Fig. 185.) BOHEMIAN WAXWING. ♂ ♀, adult: General color brownish-ash, shading insensibly from the clear ash of the tail and its upper coverts and rump into a reddish-tinged ash anteriorly, this peculiar tint heightening on the head, especially on the forehead and sides of the head, into orange-brown. A narrow frontal line, and broader bar through the eye, with the chin and throat, sooty-black, not or not sharply bordered with white. No yellowish on belly. Under tail-coverts orange-brown, or chestnut. Tail ash, deepening to blackish-ash toward the end, broadly tipped with

FIG. 185. — Bohemian Waxwings, ½ nat. size. (From Brehm.)

rich yellow. Wings ashy-blackish; primaries tipped (chiefly on the outer webs) with sharp spaces of yellow, or white, or both; secondaries with white spaces at the ends of the outer webs, the shafts usually ending with enlarged, horny, red appendages. Primary coverts tipped with white. Bill blackish-plumbeous, often paler at base below; feet black. Length 7 or 8 inches; wing about 4.50; tail 2.50. The sexes of this beautiful bird are alike, and the principal variations, aside from mere shade of the body-color, consist in the markings of the wings. In the finest specimens, the ends of the primary quills are rich yellow, like the tips of the tail-feathers, forming broad firm spaces, in a continuous line when the wing is closed, with narrower offsets going around the ends of the quills. In less perfect specimens, these markings are simply white, are less firm, and do not appear on all the quills. The secondaries may or may not show the red "sealing-wax" tips, but in adult birds at least probably always show white

markings at the ends, and the same is the case with the primary coverts. These wing-markings, with the chestnut crissum, and absence of yellowish on the belly, will always distinguish the species from *A. cedrorum*, independently of its much superior size. Young: There is an early streaked stage of plumage, like that of *A. cedrorum*. Northern hemisphere, northerly, wandering south in vast troops at irregular periods. In America, south regularly in winter to the northern tier of States; in the Rocky Mts. much further; casually to about 35°. Rare on the Pacific coast except in Alaska. Breeds in high latitudes, but down to the U. S. border in the Rocky Mts. Nesting substantially the same as that of *A. cedrorum*, and eggs only different in their greater size — about 1.00 × 0.67.

167. **A. cedro'rum.** (Lat. *cedrus*, gen. pl. *cedrorum*, the cedar. Fig. 186.) CEDAR WAXWING. CAROLINA WAXWING. CEDAR-BIRD. CHERRY-BIRD. ♂ ♀, adult: General color shading from clear pure ash on the upper tail-coverts and rump through olivaceous-cinnamon into a richer and somewhat purplish-cinnamon on the fore parts and head. On the under parts, the color shades through yellowish on the belly into white on the under tail-coverts. There is no demarcation of color whatever, and the tints are scarcely susceptible of adequate description. Frontlet, lores, and stripe through the eye, velvety-black; chin the same, soon shading into the color of the breast. A sharp white line on the side of the under jaw; a narrower one bordering the black frontlet and lores; lower eyelid white. Quills of the wings slate-gray, blackening at the ends, paler along the edges of the inner webs; without white or yellow markings, as a rule; inner quills tipped with red horny appendages. Tail-feathers like the primaries, but tipped with yellow, and sometimes also showing red horny appendages. Bill plumbeous-black, sometimes paler at base below; feet black. Length 6.50–7.25; extent 11.50–12.00; wing 3.50–3.75; tail 2.25. Young: Brownish-gray, with a slight olive shade; paler below, whitening or becoming slightly yellowish on the belly; everywhere streaked with dingy whitish; the markings most evident on the breast and sides. Wings and tail as in the adults, but usually lacking the red appendages. The velvety-black and white on the head imperfectly defined. Bill pale at base below; feet plumbeous. Specimens apparently mature and full-feathered frequently lack the sealing-wax tips. These are normally confined to the secondaries, but occasionally appear on one or several primaries, and some or all of the rectrices (as in fig. 185); a case is recorded in which an under tail-covert was similarly embellished. Both sexes possess these ornaments, but as a rule they are best developed in the ♂. The normal period of their appearance is not known — it is probably not constant; birds in the earliest known plumage may possess one or more. They are possibly deciduous, independently of moult of the feather. Their use is unknown. N. Am. at large to lat. 54° N. at least; breeds indifferently throughout its N. A. range, and migrates or rather wanders about according to food-supply; winters in most of the U. S.; goes in flocks nearly the whole year, and is especially fond of resorting to cedar thickets to feed upon the berries; breeds late (June, July) in orchards and groves; nest in trees or bushes, in the crotch of a bough or saddled on a limb; eggs 3–6, livid or pale bluish, sharply and usually thickly marked with blackish surface spots and others paler in the shell; narrow and elongate, about 0.82 × 0.60.

FIG. 186. — Cedar-bird, nat. size. (Ad nat. del. E. C.)

19. Subfamily PTILOGONATINÆ: Fly-snappers.

Bill much as in the last subfamily, but slenderer for its length: nasal scale naked; a few short bristles about base of the bill. Tarsus scutellate anteriorly, and sometimes also on

the sides; about as long as middle toe and claw; hind toe remarkably short. Wings not longer than the tail, much rounded, of 10 primaries; the 1st spurious, less than half as long as the 2d, which is only about as long as the 8th; point of the wing formed by the 4th, 5th, and 6th or 3d quills. Tail long, nearly even, with broad plane feathers (*Phaïnopepla*); or much graduated, with tapering central feathers (*Ptilogonys*). Head conspicuously crested; sexes (in our genus) dissimilar; young not streaked or spotted. There are only two genera of the subfamily as thus restricted — *Phaïnopepla* and *Ptilogonys*, the latter with two strongly marked species of Mexico and Central America.

57. **PHAÏNOPEP'LA.** (Gr. *φαεινος*, *phaeinos*, shining; *πέπλος*, *peplos*, a robe.) SHINING FLY-SNAPPERS. Bill somewhat as in *Ampelis*, but slenderer for its length; nostrils naked, scaled; antiæ bristly, reaching to nostrils; a few short rictal bristles. Tarsus scutellate anteriorly, and slightly subdivided on sides below. Hind toe very short; middle toe and claw about as long as tarsus; lateral toes a little unequal, outer the longer, reaching a little beyond base of middle claw, its basal joint adherent to middle; inner lateral toe nearly free to the base; claws all much curved. Wings not longer than tail, rounded, of 10 primaries, the 1st spurious, though more than half as long as the 2d, which about equals the length of the secondaries: point of wing formed by the 4th, 5th, and 6th quills. Tail long and fan-shaped, not emarginate, of broad plane feathers widening to their obtuse ends. Head with a long, thin, occipital crest. Sexes dissimilar: ♂ glossy black, with large white wing-patch; ♀ dull-colored; young not spotted or streaked. Fine songsters. Nidification arboreal; eggs colored.

168. **P. ni'tens.** (Lat. *nitens*, shining.) SHINING FLY-SNAPPER. ♂, adult: Entirely rich lustrous black, with steel-blue or greenish reflections. Primaries with a large white space on the inner webs. Bill and feet black. Length about 7.50 inches; "extent 11.50"; wing 3.50–3.70; tail 3.50–4.12; bill 0.40–0.50; tarsus 0.60–0.66; middle toe and claw 0.66–0.75. ♀, adult: Crested, like the ♂. Entirely brownish-gray, paler beneath, the wings and tail blackish, the white on the inner webs of the primaries much reduced or extinguished, and in its stead much whitish edging of the quills and coverts, tail-feathers, and crissum. Young ♂: Like the ♀; and during the progress to maturity every gradation between the characters of the two sexes is observed. Sometimes nearly all the feathers are skirted with white. Middle and Western Provinces, U. S., from Utah, Nevada, and Colorado southward; a bird of remarkable characters and appearance, restless and vigilant; feeds on berries and insects; sings beautifully. Nest a slight shallow structure, about 4.00 in diameter by 2.50 high, with a cavity about 2.00 deep, saddled on a bough, loosely fabricated of twigs, plant-fibres, and down; eggs 2–3 (rarely single), averaging 0.93 × 0.65, greenish-white, distinctly and profusely speckled with blackish or dark brown.

20. Subfamily MYIADESTINÆ: Fly-catching Thrushes.

Bill as in the last subfamily. Tarsus *booted*, and toes deeply cleft, as in *Turdidæ*. Lateral toes very unequal in length, the tip of the inner claw falling short of the base of the middle. Wings of 10 primaries, the 1st spurious, the 2d about as long as the 6th, the point of the wing formed by the 3d, 4th, and 5th. Tail long, about equalling the wing, *double-rounded*, being forked centrally, graduated externally; all the feathers narrowing somewhat towards the end. Head subcrested; plumage sombre, variegated on the wings; sexes alike; young spotted. Highly musical. Containing about a dozen species, mostly of the genus *Myiadestes;* others of *Cichlopsis* and *Platycichla;* all except one are birds of Central and South America and the West Indies. Though our species was formerly called "Ptilogonys," it has nothing to do with the foregoing subfamily. The *Myiadestinæ* are in fact nearly related to the *Turdidæ*. Should they be placed in that family, as might be done without violence, the comparative diagnosis would be:

TURDINÆ. — Bill moderate, scarcely or not depressed, moderately cleft. Legs stout.

Tail-feathers widening a little toward the end, the tail thus becoming squarish or fan-shaped; even or little rounded at their ends.

MYIADESTINÆ. — Bill very short, much depressed, widened at base, deeply cleft. Legs weak. Tail-feathers tapering, the tail being thus rendered somewhat cuneate, and double-rounded at end.

58. **MYIADES'TES.** (Gr. μυῖα, *muia*, a fly, and ἐδεστής, *edestes*, an eater.) FLY-CATCHING THRUSHES. Characters of the subfamily as above given.

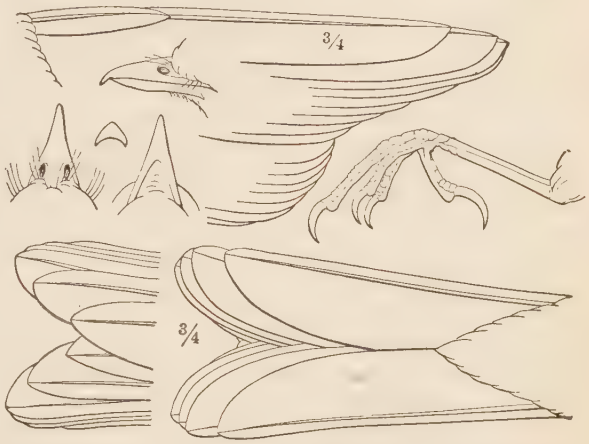

FIG. 187. — Generic details of *Myiadestes* (*M. townsendi;* bill and foot nat. size, wing and tail ¾). (From Baird.)

169. **M. town'sendi.** (To J. K. Townsend.) TOWNSEND'S FLY-CATCHING THRUSH. ♂ ♀: General color dull brownish-ash, paler below, bleaching on the throat, lower belly, and crissum. Wings blackish, the inner secondaries edged and tipped with white, nearly all the quills extensively tawny or fulvous at the base, and several of the intermediate ones again edged externally toward their ends with the same color. In the closed wing, the basal tawny shows upon the outside as an oblique spot in the recess between the greater coverts and the bastard quills, separated by an oblique bar of blackish from the second tawny patch on the outer webs of the quills near their ends. Tail like the wings (the middle pair of feathers more nearly like the back); the outer feather edged and broadly tipped, the next one more narrowly tipped, with white. A white ring around the eye. Bill and feet black. Eyes brown. Length about 8 inches; wing and tail about equal, 4.00–4.50; the latter forked centrally, graduated laterally; bill 0.50; tarsus 0.75; middle toe and claw rather more. Young: Speckled at first, like a very young thrush; each feather with a triangular or rounded spot of dull ochraceous or tawny, edged with blackish. Western U. S., from the eastern foot-hills of the Rocky Mts. to the Pacific; N. to British Columbia. A bird not less strange and unlike anything seen in the east than the *Phaïnopepla;* inhabiting woodland and shrubbery, feeding on insects and berries, and capable of musical expression in an exalted degree. Nest on the ground or in rubbish near it, loosely made of grasses; eggs about 4, bluish-white, freckled with reddish-brown, 0.95 × 0.67.

14. Family VIREONIDÆ: Vireos, or Greenlets.

FIG. 188. — Warbling Vireo, reduced. (From Tenney.)

Small dentirostral *Oscines*, related to the Shrikes, with hooked bill, 10 primaries and extensively coherent toes. Bill shorter than the head, stout, compressed, distinctly notched and hooked at tip; rictus with conspicuous bristles; nostrils exposed, overhung with a scale, but reached by the small bristly erect frontal feathers. Toes soldered at base for the whole length of the basal joint of the middle one, which is united with the basal joint of the inner and the two basal joints of the outer, all these coherent phalanges very short. (Lateral toes unequal in the genus *Vireo*.) Tarsus equal to or longer than the middle toe and claw, scutellate in front, laterally undivided, except at extreme base. Wings moderate, of 10 primaries, of

which the 1st is short (one-half to one-fourth the second), or spurious, or *apparently* wanting (being rudimentary and displaced). Size small, under 7 inches; coloration simple, mostly and oftenest greenish; young not spotted or streaked.

This family was formerly united with the next (*Laniidæ*), chiefly on account of the resemblance in the shape of the bill of certain species to that of the shrikes; but the likeness is never perfect, and there are other more important characters, especially in the structure of the feet, by which the two groups may be discriminated. The *Vireonidæ* are peculiar to America; they are a small family of five or six genera and nearly seventy recorded species, of which about five-sixths appear to be genuine. The typical and principal genus, *Vireo*, containing nearly thirty species, is especially characteristic of North America, though several species occur in the West Indies and Central America; one genus and species, *Laletes osburni*, is exclusively West Indian; the rest — *Cyclarhis*, *Hylophilus*, *Vireolanius*, and *Neochloe* — are, with one exception, South and Central American. In further illustration of the characters of the group, I offer some remarks under the head of the only genus with which we have to do in the present connection.

59. **VIR'EO.** (Lat. *vireo*, I am green or flourishing.) GREENLETS. Bill like that of a shrike in miniature, moderately or very stout, shorter than the head, compressed at least toward the end, distinctly hooked and notched at the tip, sometimes with trace of a tooth behind the notch of the upper mandible, and usually a nick in the under mandible too. Rictal bristles conspicuous, and others present among the frontal and mental feathers. Nasal fossæ nearly filled with short erect feathers. Toes extensively coherent at base, as explained under head of the family; lateral toes of unequal lengths; claws stout, narrowly compressed, much curved and acute. Wings at least as long as the tail, more or less rounded; sometimes much longer and quite pointed; of 10 primaries, the 1st usually evident, though short and spurious, but sometimes (in the section *Vireosylvia* and in *Vireo flavifrons*) rudimentary and more or less completely concealed (exceptionally obvious even in these species). Tail short, even, of narrow feathers. Size small; length usually five or six inches. Coloration simple; above olivaceous or grayish, the crown like the back, or ashy (in one case brown, in another black), the under parts white, or white and yellow, or partly olivaceous. Sexes quite indistinguishable; young similar, not spotted or streaked. Migratory in N. Am. Insectivorous, arboricole. Nest pendulous; eggs white, spotted.

The numerous species of this genus have been divided into several groups, but no violence will be done by considering them all as *Vireo* — in fact, it is difficult to do otherwise. For even the seemingly substantial division into two genera, according as there is an evident spurious 1st primary or apparently none, separates species, like *gilvus* and *philadelphicus*, hardly otherwise specifically distinguishable; while another division into two genera, according to the shape of the wings and length of the spurious 1st primary or its absence, is subject to some uncertainty of determination, and unites species, like *olivaceus* and *flavifrons*, most dissimilar in other respects. The fact is, that almost every single species of *Vireo* has its own peculiar form, in shape of bill, proportions of primaries, etc., and these details cannot well be considered as of more than specific value. These slight differences are perfectly tangible and surprisingly constant, rendering the determination of the species comparatively easy, though these birds bear to each other a close general resemblance in size and color. They are all more or less *olivaceous* above, sometimes inclining to gray or plumbeous, with the crown either like the back, or else ashy, — in one species, however, brown, and in another black; and white or whitish below, usually more or less tinged with yellow. The coloration is very constant, the sexes being indistinguishable, and the young differing little, if at all, from the adults. All are small birds, — about 5 or 6 inches long. As a group the student will probably have no difficulty in recognizing them by the foregoing diagnosis, as the character of the feet seems to be peculiar, among N. Am. birds, and is at any rate diagnostic when taken in connection with the

character of the bill, — all those *Oscines*, as wrens, creepers, or titmice, that show much cohesion of the toes, having an entirely different bill. Some of the weaker-billed species might be carelessly mistaken for warblers; but there is no excuse for this, nor for confounding them with any of the little clamatorial flycatchers. The Vireos were long supposed to possess either 9 or 10 primaries. But that the important character of number of primaries — one marking whole families as we have seen — should here subside to specific value only, seemed suspicious; and the fact is that all the species really have 10, only that, in some instances, the 1st primary is rudimentary and displaced, lying concealed outside the base of the second quill. The N. Am. species are distributed over the temperate portions of this continent, and several of them are abundant birds of the Atlantic States, inhabiting woodland and shrubbery. They are exclusively insectivorous, and are therefore necessarily migratory in our latitudes. They build a neat pensile nest in the fork of a branchlet, and commonly lay four or five white, speckled eggs. All are alike in this respect, the nest and eggs of none of the species (excepting *atricapillus*) being distinguishable with certainty, though differing in size with that of the parent, and somewhat in position, according as the parents are birds of woodland or shrubbery; it would be useless, therefore, to give particular descriptions for each species. Next after the warblers, the greenlets are the most delightful of our forest birds, though their charms address the ear and not the eye. Clad in simple tints that harmonize with the verdure, these gentle songsters warble their lays unseen, while the foliage itself seems stirred to music. In the quaint and curious ditty of the white-eye — in the earnest, voluble strains of the red-eye — in the tender secret that the warbling vireo confides in whispers to the passing breeze — he is insensible who does not hear the echo of thoughts he never clothes in words.

Analysis of Species.

Primaries apparently 9 (the 1st rudimentary and displaced). **(a)**
Primaries evidently 10 (the 1st short or spurious). **(b)**

(a) Throat yellow . . . . . *flavifrons* 176
— white; crown ashy, not black-edged, hardly contrasting with back . . . . . *philadelphicus* 173
— black-edged; back olive; with maxillary streaks . . . . . *barbatulus* 172
— no maxillary streaks; crissum merely yellowish *olivaceus* 170
— bright yellow *flaviviridis* 171

(b) Crown black . . . . . *atricapillus* 185
— not black; spurious quill at least ½ as long as 2d, and wing 2.50 long . . . . . *vicinior* 180
— not ½ as long as 2d, or wing not 2.50 long **(c)**

(c) Wing-bands wanting: coloration as in *philadelphicus* . . . . . *gilvus* 174, 175
— present; length over 5.00; back olive, contrasting with ashy-blue crown . . *solitarius* 177, 178
— plumbeous, crown scarcely different . . . . . *plumbeus* 179
— 5.00 or less; wing = tail, both about 2.25; 1st quill = ½ the 2d . . . *pusillus* 184
— > tail; crown ashy, chin and superc. line white . . . *belli* 183
— olive, chin wht., superc. line yell. . *novebor.* 181
— and under parts yell'sh . . *huttoni* 182

170. V. oliva'ceus. (Lat. *olivaceus*, olive-colored. Fig. 189.) RED-EYED GREENLET. Above, olive-green; crown ash, edged on each side with a blackish line, below this a white superciliary line, below this again a dusky stripe through eye; under parts white, faintly shaded with greenish-yellow along sides, and tinged with the same on under wing- and tail-coverts; wings and tail dusky, the feathers edged with

FIG. 189. — *V. olivaceus*, nat. size. (From Baird.)

olive outside, with whitish inside; bill dusky above, pale below; feet leaden-blue; eyes red: no dusky maxillary streaks; no apparent spurious quill. Little different with age, sex, or season; young and fall birds the brightest colored, especially on the sides, crissum, and lining of wings. Large; length 5.75–6.25; extent 9.75–10.75; wing 3.00–3.33; tail 2.33–2.50; bill about 0.66; tarsus 0.75. E. N. Am.; N. to Hudson's Bay and even Greenland; W. sometimes to Utah and Washington Territory; breeds throughout its U. S. range, and winters from the Gulf States southward. In most places the most abundant species of the genus, in woodland; a voluble, tireless songster.

171. V. flavivi'ridis. (Lat. *flavus*, yellow; *viridis*, green. Fig. 190.) YELLOW-GREEN GREENLET. Very similar to the last; more yellowish below; under wing- and tail-coverts decidedly yellow; sides of body decidedly greenish-yellow. Texas and southward.

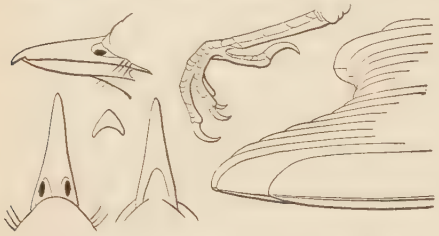

FIG. 190. — *V. flaviviridis*, nat. size. (From Baird.)

FIG. 191. — *V. a. barbatulus*, nat. size. (From Baird.)

172. V. alti'loquus barba'tulus. (Lat. *altus*, high, *loquus*, speaking; *barbatulus*, having a little beard. Fig. 191.) BLACK-WHISKERED GREENLET. WHIP-TOM-KELLY. Similar to *olivaceus*; distinguished by a narrow dusky maxillary line, or line of spots, on each side of the chin; bill longer, 0.75–0.80; proportion of quills slightly different (see the figs.). Cuba, Bahamas, and casually in Florida. [*V. altiloquus* is the West Indian stock-form.]

173. V. philadel'phicus. (Gr. φιλέω, *phileo*, I love; ἀδελφός, brother. Fig. 192.) BROTHERLY-LOVE GREENLET. Above, dull olive-green, brightening on the rump, fading insensibly into ashy on the crown, which is not bordered with blackish; a dull white superciliary line; below, palest possible yellowish, whitening on throat and belly, slightly olive-shaded on sides; sometimes a slight creamy or buffy shade throughout the under parts; no obvious wing-bars; no apparent spurious quill. Length 4.80–5.10; extent 8.00–8.50; wing 2.66; tail 2.25; bill hardly or about 0.50; tarsus 0.66. Eastern N. Am., strictly; N. to Hudson's Bay; a small, plainly-colored species, almost indistinguishable from *gilvus* except by apparent absence of a spurious quill; not very common in the Atlantic States, more so in the Mississippi Valley.

FIG. 192. — *V. philadelphicus*, nat. size. (From Baird.)

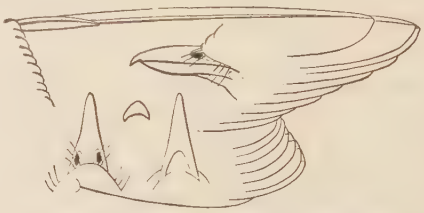

FIG. 193. — *V. gilvus*, nat. size. (From Baird.)

174. V. gil'vus. (Lat. *gilvus*, yellowish. Figs. 188, 193.) WARBLING GREENLET. Colors precisely as in the last species; spurious quill present and evident, ½ to ⅓ as long as the 2d primary. Length 5.50–6.00; extent 8.50–9.25; wing 2.80; tail 2.25; bill 0.40; tarsus 0.65. Eastern N. Am. to the high central plains, breeding throughout its range; wintering extralimital; an abundant little bird and an exquisite songster. Its voice is not strong, and many birds excel it in brilliancy of execution; but not one of them all can rival the tenderness and softness of

the liquid strains of this modest vocalist. Not born to "waste its sweetness on the desert air," the warbling vireo forsakes the depths of the woodland for the park and orchard and shady street, where it glides through the foliage of the tallest trees, the unseen messenger of rest and peace to the busy, dusty, haunts of men.

175. **V. g. swain′soni?** (To Wm. Swainson. Fig. 194.) WESTERN WARBLING VIREO. "Similar to *V. gilvus*, but smaller; colors paler; bill more depressed; upper mandible almost black; 2d quill much shorter than 6th." Rocky Mts. to the Pacific, U. S. This Western form has been described as distinct, but the characters assigned will not be found constant. It is simply a dull-colored race, like many other birds of this region.

FIG. 194. — *V. g. swainsoni*, nat. size. (From Baird.)

FIG. 195. — *V. flavifrons*, nat. size. (From Baird.)

176. **V. fla′vifrons.** (Lat. *flavus*, yellow; *frons*, front.) YELLOW-THROATED GREENLET. Above, rich olive-green, crown the same or even brighter, rump insensibly shading into bluish-ash; below, bright yellow, belly and crissum abruptly white, sides anteriorly shaded with olive, posteriorly with plumbeous; extreme forehead, superciliary line and ring round eye, yellow; lores dusky; wings dusky, with the inner secondaries broadly white-edged, and two broad white bars across tips of greater and median coverts; tail dusky, nearly all the feathers completely encircled with white edging; bill and feet dark leaden-blue; no apparent spurious quill. Length 5.75–6.00; extent about 10.00; wing about 3.00; tail only about 2.25. A large, stout, highly-colored species, curiously resembling *Icteria virens*, common in the woods of the Eastern U. S., and adjoining British Provinces; W. only to the edge of the plains; winters in Florida and southward; breeds in all its U. S. range. Its proper name may be *V. ochroleucus*.

177. **V. solita′rius.** (Lat. *solitarius*, solitary; *solus*, alone. Fig. 196.) BLUE-HEADED GREENLET. SOLITARY GREENLET. Above, olive-green; crown and sides of head bluish-ash in marked contrast, with a broad white line from nostrils to and around (not beyond) eye, and a dusky loral line; below, pure white, flanks washed with olivaceous, and axillars and crissum pale yellow; wings and tail dusky, most of the feathers edged with white or whitish, and two conspicuous bars of the same across tips of middle and greater coverts; bill and feet blackish-plumbeous; iris brown. Length 5.25–5.75; extent 8.50; wing 2.75–3.00; tail 2.25–2.33; bill about 0.40, stout, nearly 0.20 deep at base; spurious quill 0.50–0.66 long, about ¼ as long as 2d primary. Young and fall specimens more brightly colored. A stoutly-built species, known at a glance by the bluish cap. Eastern U. S. and Canada; not rare, but not so common as *olivaceus*, *flavifrons*, or *noveboracensis*: inhabits woodland.

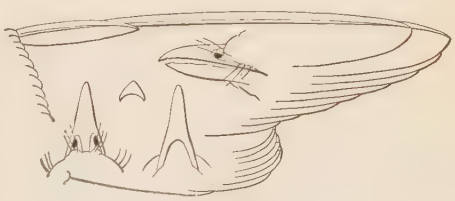

FIG. 196. — *V. solitarius*, nat. size. (From Baird.)

178. **V. s. cas′sini.** (To John Cassin.) CASSIN'S GREENLET. Scarcely different; said to be duller and more brownish-olivaceous; under parts tinged with buff or ochrey where *solitarius* is pure white; loral line and eye-ring impurely whitish. Arizona and California. (Not at all like *V. plumbeus*, with which it is geographically associated.)

179. V. s. plum'beus. (Lat. *plumbeus*, lead-colored. Fig. 197.) PLUMBEOUS GREENLET. Leaden-gray, rather brighter and more ashy on the crown, but without marked contrast, faintly glossed with olive on rump; a conspicuous white line from nostril to and around eye, and below this a dusky loral stripe; below, pure white, sides of neck and breast shaded with the color of the back, flanks, axillars and crissum with a mere trace of olivaceous, or none; wings and tail dusky, with conspicuous pure white edgings and cross-bars. Size of *solitarius* or larger. Length 5.75–6.10; extent 9.75–10.25; wing 2.90–3.10; tail 2.50; bill 0.50; tarsus 0.66; middle toe the same; spurious quill exposed about 0.75, ⅛ as long as the 2d quill. Central Plains to the Pacific, U. S., and especially Southern Rocky Mts., where it is abundant. A large stout species, a near ally of *solitarius*, but nearly all the olivaceous of that species replaced by plumbeous, and the yellowish by white, so that it is a very different-looking bird. Fall specimens, however, are more olivaceous, and the bird evidently grades closely up to *solitarius*.

FIG. 197. — *V. s. plumbeus*, nat. size. (From Baird.)

180. V. vici'nior. (Lat. *vicinus*, neighboring.) GRAY GREENLET. With the general appearance of a small faded specimen of *plumbeus:* leaden-gray, faintly olivaceous on the rump, below white, with hardly a trace of yellowish on the sides; wings and tail hardly edged with white; no markings about head except a whitish eye-ring. Length 5.75; extent 8.66; wing and tail each 2.50; tarsus nearly 0.75; middle toe and claw hardly over 0.50; tip of inner claw falling short of base of middle claw; tail decidedly rounded; spurious quill exposed 0.75, ½ as long as the 2d primary, which latter is not longer than the 8th. These peculiar proportions of the original type specimen are constant, and the species is distinct from any other. It is our plainest-colored species, resembling *plumbeus*, but more closely allied to the smaller rounder-winged species like *noveboracensis* and especially *pusillus;* the toes are almost abnormally short, and the tail is as long as the wing. Arizona and New Mexico. The type-specimen long remained unique, but others have since been found.

181. V. noveboracen'sis. (Lat. *novus*, new, *Eboracum*, York. Fig. 198.) WHITE-EYED GREENLET. Above, bright olive-green, including crown; a slight ashy gloss on the cervix, and the rump showing yellowish when the feathers are disturbed; below, white, the sides of the breast and belly, with axillars and crissum, bright yellow; a bright yellow line from nostrils to and around eye; lores dusky; two broad yellowish wing-bars; inner secondaries widely edged with the same; bill and feet blackish-plumbeous; eyes white. About 5 inches long; extent 8.00; wing 2.33–2.50; tail 2.25; spurious quill exposed 0.75, ½ as long as the 2d, which about equals the 8th; tarsus about 0.75; middle toe and claw 0.50; bill nearly 0.50. A small, compact, brightly-colored species, abundant in shrubbery and tangle of the Eastern U. S.; W. rarely to the Rocky Mts.; rather southerly, N. only to the Connecticut Valley; noted for its sprightly manners and emphatic voice.

FIG. 198. — *V. noveboracensis*, nat. size. (From Baird.)

182. V. hut'toni. (To Wm. Hutton, of Cala. Fig. 199.) HUTTON'S GREENLET. Similar to the last, but differing much as *flaviviridis* does from *olivaceus*, in having the under parts almost

entirely yellowish. California. First quill rather less than half the 2d, which about equals the 10th; 3d a little longer than 7th; 4th and 5th nearly equal and longest. Tail slightly rounded, shorter than the wings. Bill very small. Above olive-green; brightest behind, especially on rump and edging of tail; duller and more ashy toward and on top and sides of head and neck. Wings with two bands on coverts, and outer edges of innermost secondaries rather broadly olivaceous-white; other quills edged externally with olive-green, paler toward outer primary, internally with whitish. Lateral tail-feathers edged externally with yellowish-white. Feathers of rump with much concealed yellowish-gray. Under parts pale olivaceous-yellowish, purest behind, lightest on throat and abdomen; the breast more olivaceous, the sides still deeper olive-green, the breast soiled with a slight buffy tinge. Axillars and crissum yellowish, the inside of wings whitish. Loral region and narrow space around eye dull yellowish, in faint contrast to the olive of head. Bill horn-color above, paler below; legs dusky. Length 4.70; wing 2.40; tail 2.05. (Description from Baird.)

FIG. 199. — *V. huttoni*, nat. size. (From Baird.)

182a. **V. h. ste'vensi.** (To F. Stephens.) STEPHENS' GREENLET. Like *V. huttoni.* Bill stout; wings from 0.30–0.40 longer than tail. Above, grayish-ash; the crown, vertex and sides of head and neck nearly pure ash; the back faintly tinged with olive; the rump and an edging on the tail-feathers dull olive-green. Wings with two nearly confluent bands on the coverts, and the outer edges of the inner secondaries broadly white; outer quills edged more narrowly with the same color. Beneath brownish or smoky-white, with a mere wash of yellowish on the sides and crissum. Upper eyelid dusky-brown; remainder of the orbital region, with the lores, ashy-white in decided contrast with the nearly clear cinereous of the head generally. Lining of wings white. Length 5.20; extent 8.50; wing 2.55–2.90; tail 2.25; tarsus 0.73; culmen 0.50. Arizona and New Mexico, especially in mountain ranges. Related to *huttoni*, which has bill less stout, wing 2.40 *or less*, and is olive-green above and olivaceous-yellow below, without clear white anywhere. The differences are nearly parallel with those between *belli* and *pusillus*, — *stevensi* being grayish-ash above with no decided olive-green excepting on the rump and tail, brownish-white below, untinged with yellowish excepting on sides and crissum, the wing-bands pure white and nearly confluent. (Not in Check List, 1880. Description from Brewster, Bull. Nutt. Club, vii, 1882, p. —.)

183. **V. bel'li.** (To J. G. Bell, of New York. Fig. 200.) BELL'S GREENLET. Olive-green, brighter on rump, ashier on head, but without decided contrasts; head-markings almost exactly as in *gilvus;* below, sulphury-yellowish, only whitish on chin and middle of belly; inner quills edged with whitish; two whitish wing-bands, but one more conspicuous than the other. Hardly or not 5.00 long; wing scarcely over 2.00; tail under 2.00; spurious quill about $\frac{2}{5}$ the 2d, which equals or exceeds the 7th. A pretty little species, like a miniature of *gilvus*, but readily distinguished from that species by its small size, presence of decided wing-bars, more yellowish under-parts, and different wing-formula. Middle region of the U. S., W. to the Rocky Mts., E. to the valley of the Ohio; an abundant species, inhabiting copses and shrubbery in open country, with much the same sprightly ways and loud song as those of *noveboracensis.*

FIG. 200. — *V. belli*, nat. size. (From Baird.)

184. **V. pusil'lus.** (Lat. *pusillus*, puerile, petty. Fig. 201.) LEAST GREENLET. Olivaceous-gray, below white, merely tinged with yellowish on the sides; head-markings obscure; wing-

bands and edgings, though evident, narrow and whitish; no decided olive or yellow anywhere. Size of *belli;* wing and tail of equal lengths, little over 2.00; bill 0.33; tarsus 0.66; middle toe and claw 0.50; spurious quill about ½ as long as the 2d, which is intermediate between the 7th and 8th. A small, obscure-looking species, resembling *belli*, but much grayer, tail relatively longer, spurious quill longer, and 2d primary shorter. Arizona and Southern California, common.

FIG. 201. — *V. pusillus*, nat. size. (From Baird.)

185. **V. atricapillus.** (Lat. *ater*, black; *capillus*, hair.) BLACK-CAPPED GREENLET. ♂: Top and side of the head black, excepting a white eye-ring and white loral stripe. Upper parts olivaceous; lower parts white, tinged with pale greenish on the sides and flanks. Wings and tail blackish, edged with olivaceous, the former with two dingy whitish bars across the ends of the greater and median coverts; lining of wings yellowish. Bill black; feet dark; iris red. Length 4.75; extent 7.25; wing 2.25; tail nearly 2.00; bill 0.50; tarsus 0.75; middle toe and claw 0.50; 1st primary exposed 0.66. A specimen from Mazatlan, supposed to be a ♀, is described by Baird and Ridgway as having the black of the head replaced by dark slate color, the upper parts duller olive, the lower somewhat buffy. The black cap of the ♂ renders the species conspicuous among all its congeners. Texas and Mexico, rare; few specimens known. Nest in trees, pensile from a forked twig as usual in the genus, but eggs white, unmarked (as far as known; 15 examples examined); size 0.65–0.75 × 0.50–0.55.

15. Family LANIIDÆ: Shrikes.

FIG. 202. — Shrikes' Bills, nat. size. (From Baird.)

Essentially characterized by the combination of comparatively weak, strictly passerine feet with a notched, toothed and hooked bill, the size, shape, and strength of which recalls that of a bird of prey (fig. 202.). The family comprises about 200 recorded species, referable to numerous genera and divisible into three groups, not very well defined, however, of which the following typical subfamily is the only one occurring in America: —

21. Subfamily LANIINÆ: True Shrikes.

In this group the wing has 10 primaries and the tail 12 rectrices; both are much rounded and of nearly equal lengths. The rictus is furnished with strong bristles. The circular nostrils are more or less perfectly covered and concealed by dense tufts of antrorse bristly feathers. The tarsi are scutellate in front and on the outside — in the latter respect deviating from a usual Oscine character. Our shrikes will thus be easily distinguished; additional features are given under head of the genus *Lanius*, the only representative of this group in America.

FIG. 203. — Butcher-bird, reduced. (From Tenney, after Wilson.)

These shrikes are bold and spirited birds, quarrelsome among themselves, and tyrannical toward weaker species; in fact, their nature seems as highly rapacious as that of the true birds of prey. They are carnivorous,

feeding on insects and such small birds and quadrupeds as they can capture and overpower; many instances have been noted of their dashing attacks upon cage-birds, and their reckless pursuit of other species under circumstances that cost them their own lives. But the most remarkable fact in the natural history of the shrikes is their singular and inexplicable habit of impaling their prey on thorns or sharp twigs, and leaving it sticking there. This has occasioned many ingenious surmises, none of which, however, are entirely satisfactory. They build a rather rude and bulky nest of twigs, and lay 4–6 speckled eggs. They are not strictly migratory, although our northernmost species usually retires southward in the fall. The sexes are alike, and the young differ but little. There are only two well determined American species, of nine that compose the genus.

60. **LA'NIUS.** (Lat. *lanius*, a butcher.) GRAY SHRIKES. Wing of 10 primaries, and tail of 12 rectrices, both rounded in shape, and of nearly equal lengths. Point of the wing formed by the 3d, 4th, and 5th quills, the second not longer than the 6th, and the 1st about half as long as the 3d. Tarsus equalling or slightly exceeding in length the middle toe and claw, strongly scutellate in front, and with the outer lateral plate usually more or less subdivided, as is unusual among *Oscines*. Lateral toes of about equal lengths, their claws reaching to the base of the middle claw; inner toe cleft nearly to the base, the outer more extensively coherent with the basal joint of the middle toe. Feet large and strong, but without specially "raptorial" development either of the digits or of their claws. Bill large and powerful, compressed, deep, completely notched and toothed, and strongly hooked, presenting the full accomplishment of a raptorial character. Rictus ample and deeply cleft, and strongly bristled; gonys short, only about half the length of the lower mandible. Nostrils circular or nearly so, placed well forward in the nasal fossæ, more or less perfectly overhung and concealed by tufts of antrorse bristly feathers. Body stout; neck short; head relatively large. Coloration simple, the black, white, and bluish or grayish tints being unrelieved by red or other bright color. In the amount of the dusky vermiculation of the under parts the species are graded from *borealis* (most) to *excubitorides* (least or none), and each one is graded from young to old. In all, the general resemblance to a mocking-bird is striking.

Analysis of Species.

Large: length 9.00 or over. Black head-stripe broken on under eyelid and across forehead. Always waved below with dusky . . . . . *borealis* 186

Small: length under 9.00. Black head-stripe unbroken across forehead: no white on under eyelid. Adults unwaved below.

Lighter: much white on rump and scapulars; long white patch on primaries . . . *excubitorides* 188

Darker: little white on rump and scapulars; short white patch on primaries . . . *ludovicianus* 187

186. **L. borea'lis.** (Lat. *borealis*, northern. Figs. 203, 204.) GREAT NORTHERN SHRIKE. BUTCHER-BIRD. ♂ ♀, adult: Above, clear bluish-ash, blanching on rump and scapulars; below, white, always vermiculated transversely with fine wavy blackish lines; a broad black bar along side of head, *not* meeting its fellow across forehead, interrupted by a white crescent on under eyelid, and bordered above by hoary white that also occupies the extreme forehead; wings and tail black, the former with a large white spot near base of the primaries, and white tips of most of the quills, the latter with the outer web of the outer feather edged, and all the feathers excepting the middle pair broadly tipped, with white, and with concealed white bases; bill and feet bluish-black; eyes blackish. Length

FIG. 204. — Butcher-bird (*L. borealis*), nat. size. (Ad nat. del. E. C.)

9.00–10.00; extent 13.50–14.50; wing 5.00–5.50; tail rather more; bill 0.75; tarsus 0.90; middle toe and claw 0.75. Young: The colors much less pure and clear. Above, grayish-brown, scarcely or not whitening on the scapulars, tail-coverts, and forehead. The younger the browner, sometimes almost with a rusty tinge; grayer according to age. Below brownish-white (the younger the browner), the wavy dark markings stronger than in the adult. The bar along the head poorly defined, merely dusky, or quite obsolete. Wings and tail brownish-black, with less white than in the adult. Bill plumbeous-brown, flesh-colored at base below. At a very early age, the upper parts are probably vermiculated somewhat like the lower, as in the same stage of *L. ludovicianus;* but this state I have not observed. In old age, the dusky vermiculation of the under parts is much diminished, but I have never seen it absent altogether. This feature, coupled with the particular character of the head-markings and the large size and comparatively short tarsi, will always distinguish the species from *L. ludovicianus* or *excubitorides*. N. Am., northerly; breeds, however, on mountains of the Middle States and in New England; in winter, usually extends S. to about 35°. The castle of this "feudal baron and brigand bold" is built in a bush or low tree with a basement of sticks, upon which is matted and felted a thick warm superstructure of bark-strips, grasses, and soft vegetable substances: eggs 4–6, about 1.10 × 0.80, rather elliptical in shape, so profusely speckled, scratched, and marbled with reddish, brownish, and purplish shades that the greenish-gray ground color is scarcely perceptible.

187. L. ludovicia'nus. (Lat. *ludovicianus*, of Louisiana.) LOGGERHEAD SHRIKE. ♂ ♀, adult: Above, slate-colored, slightly whitish on upper tail-coverts and ends of scapulars; below, white, sometimes a little ashy-shaded, but no wavy black lines, or only a few slight ones; white on wings and tail less extensive than in *borealis* or *excubitorides;* black bridle meeting its fellow across forehead, not interrupted by white on lower eyelid, scarcely or not bordered above by hoary white. Smaller: length 8.00–8.50; wing and tail each 4.00 or little more; tarsus at least 1.00, thus relatively longer than in *borealis;* bill about 0.50. Young: differing from the adult much as young *borealis* does, and decidedly waved below, as in that species: but the size and other characters are distinctive. Eastern and Southern U. S., resident, abundant; in its typical manifestation it is characteristic of the S. Atlantic States; but specimens more like *ludovicianus* than *excubitorides* occur N. to New England and W. to Ohio.

188. C. l. excubitori'des. (Lat. *excubitor*, a sentinel; Gr. εἶδος, *eidos*, resemblance; i. e., like the European *L. excubitor*.) WHITE-RUMPED SHRIKE. COMMON AMERICAN SHRIKE. ♂ ♀, adult: Leaden-gray or light slate-color, whitening on the scapulars and upper tail-coverts. Beneath, white, slightly shaded with the French gray on the sides, but without dusky vermiculation. A narrow stripe across the forehead, continuous with a broad bar along the side of the head, embracing the eye, black, slightly, if at all, bordered with whitish. Lower eyelid not white. Wings and tail black, with white markings, much as in the last species. Bill and feet plumbeous-black. Length under 9.00; extent 12.00–13.00; wing and tail, each, about 4.00; bill 0.66; tarsus 1.00 or more. Young: Vermiculated below with dusky, upon a brownish ground, about to the same extent as is seen in very old examples of *L. borealis*. General tone of the upper parts less pure than in the adult; scapulars and tail-coverts not purely white; black bar of head less firm, but as far as it goes maintaining the characters of the species. At a very early age, the upper parts, including the whitish of the scapulars and tail-coverts, are finely vermiculated with dusky waves. The ends of the quills, wing-coverts, and tail-feathers often have rusty or rufous markings. Extreme examples of *excubitorides* look very different from *ludovicianus* proper, but the two are observed to melt into each other when many specimens are compared, so that no specific character can be assigned. Middle and Western N. Am. and Mexico; N. to the region of the Saskatchewan, E. to Ohio, New York, Canada and even New England.

16. Family FRINGILLIDÆ: Finches, etc.

FIG. 205. — European Chaffinch (*Fringilla cœlebs*). (After Dixon.)

Conirostral Oscines with 9 primaries. — The largest North American family, comprising about one-seventh (123 : 888) of all our birds, and the most extensive group of its grade in ornithology. As ordinarily constituted, it represents, in round numbers 500 current species and 100 genera, of nearly all parts of the world, except Australia, but more particularly of the northern hemisphere and throughout America, where the group attains its maximum development. Any one United States locality of average attractiveness to birds has a bird-fauna of over 200 species; and if it be away from the sea-coast, and consequently uninhabited by marine birds, about one-fourth of its species are *Sylvicolidæ* and *Fringillidæ* together — the latter somewhat in excess of the former. It is not easy, therefore, to give undue prominence to these two families.

The *Fringillidæ* are more particularly what used to be called "conirostral" birds, in distinction from "fissirostres," as the swallows, swifts, and goatsuckers, "tenuirostres," as humming-birds and creepers, and "dentirostres," as warblers, vireos, and most of the preceding families. The bill approaches nearest the ideal cone, combining strength to crush seeds, with delicacy of touch to secure minute objects. The cone is sometimes nearly expressed, but is more frequently turgid or conoidal, convex in most directions or, again, so contracted that some of its outlines are concave. The nostrils are always situated *high up* — nearer the culmen than the cutting edge of the bill; they are usually exposed, but in many, chiefly boreal, genera, the base of the bill is furnished with a ruff or two tufts of antrorse feathers more or less completely covering the openings. The cutting edges of the bill may be slightly notched, but are usually plain. There are usually a few inconspicuous bristles about the rictus, sometimes wanting, sometimes highly developed, as in our grosbeaks. The wings are endlessly varied in shape, but agree in possessing only nine developed primaries; the tail is equally variable in form, but always has twelve rectrices. The feet show a strictly Oscine or laminiplantar podotheca, scutellate in front, covered on each side with an undivided plate, producing a sharp ridge behind. None of these members offer extreme phases of development in any of our species.

But the most tangible characteristic of the family is *angulation of the commissure.* The commissure runs in a straight line, or with a slight curve, to or near to the base of the bill, and is then more or less abruptly bent down at a varying angle — the cutting edge of the upper mandible forming a reëntrance, that of the lower mandible a corresponding salience. In familiar terms, we might say that the corners of the mouth are drawn down — that the Finches, though very merry little birds, are literally "down in the mouth." In the great majority of cases this feature is unmistakable, and in the grosbeaks, for example, it is very strongly marked

indeed; but in some of the smaller-billed forms, and especially those with slender bill, it is hardly perceptible. On the whole, however, it is a good character, and at any rate it is the most reliable external feature that can be found. It separates our fringilline birds pretty trenchantly from other 9-primaried Oscines except *Icteridæ*, and most of these may be distinguished by the characters given beyond.

Taking their characters all together, *Fringillidæ* may be defined as 9-primaried conirostral laminiplantar oscine Passeres with axis of bill at an angle with that of skull, and nostrils nearer culmen than cutting edge of bill.

When we come, however, to consider this great group of conirostral Oscines in its entirety, as compared with bordering families like the Old World *Ploceidæ*, or the *Icteridæ*, and especially the *Tanagridæ*, of the New, the difficulty if not the impossibility of framing a perfect diagnosis becomes apparent, and I am not aware that any attempts at rigid definition have proven successful. Ornithologists are nearly agreed what birds to call fringilline, without being so well prepared to say what "fringilline" means. The subdivisions of the family, as might be expected, are still conventional, and varying with every leading writer. Our species might be thrown into several groups, but the distinctions would be more or less arbitrary and not readily perceived. It is therefore best to waive the question, and simply collocate the genera in orderly sequence.

The *Fringillidæ* are popularly known by several different names. Here belong all the *sparrows*, with the allied birds called finches, buntings, linnets, grosbeaks and crossbills. In the following pages I describe 123 species and subspecies, mostly well determined, and ascertained to occur within our limits, referring them to 37 genera, as the custom is, although I think this number of genera altogether too large. Two of them, *Passer domesticus* and *P. montanus*, are imported and naturalized. Species occur throughout our country, in every situation, and many of them are among our most abundant and familiar birds. They are all granivorous — seed-eaters, but many feed extensively on buds, fruits, and other soft vegetable substances, as well as on insects. They are not so perfectly migratory as the exclusively insectivorous birds, the nature of whose food requires prompt removal at the approach of cold weather; but, with some exceptions, they withdraw from their breeding places in the fall to spend the winter farther south, and to return in the spring. With a few signal exceptions they are not truly gregarious birds, though they often associate in large companies, assembled in community of interest. The modes of nesting are too various to be here summarized. Nearly all the finches sing, with varying ability and effect; some of them are among our most delightful vocalists. As a rule, they are plainly clad — even meanly, in comparison with some of our sylvan beauties; but among them are birds of elegant and striking colors. Among the highly-colored ones, the sexes are more or less unlike, and other changes, with age and season, are strongly marked; the reverse is the case with the rest.

The unpractised student will have more trouble in this family than elsewhere in identifying his specimens. In the first place, the genera and species are very numerous, and so variously interrelated that no satisfactory subfamilies have been established; they are therefore not parcelled out in sets. Secondly, all the genera cannot be discriminated in a line of type. To meet the difficulty, I have caused the family to be profusely illustrated with cuts of more than average excellence, and attempted a tabular analysis of the genera, which, though necessarily defective, will doubtless help to some extent. Speaking roundly, there are three lots of genera: (*a*) *Loxiine*, mostly boreal birds, sexed unlike, ♂ often red, ♀ dull, no blue, colors massed or streaky, bill usually ruffed at base, wings pointed, tail forked, feet weak; (*b*) *Spizelline*, everywhere, mostly small streaked and spotted species, sexed alike, may be yellowed but are never red or blue, wings, tail, and feet various; (*c*) *Spizine*, mostly southerly, sexed unlike, ♂ often red or blue, bill unruffed, wings, tail, and feet various; — but nothing will serve to distinguish these groups unexceptionally.

Analysis (partial) of Genera.

Bill *metagnathous*, both mandibles falcate, their points crossed. ♂ red, ♀ dark and yellowish . *Loxia* 66
Bill enormous, nearly = tarsus, *greenish-yellow*. Wings black and white; tail and tibiæ black. (Western.) *Hesperophona* 61
Bill parrot-like, *whitish*. Head conspicuously crested. ♂ ♀ gray and carmine, face not black. Length 7.50 or more. (S. W. U. S.) . . . . . *Pyrrhuloxia* 94
Bill *reddish*. Head conspicuously crested. ♂ vermilion, face black. ♀ gray and reddish. Length 7.50 or more. (E. and S. U. S.) . . . . . *Cardinalis* 95
Bill with a *ruff*, or pair of *nasal tufts*, of antrorse plumules, at base of upper mandible.
Length 8.00 or more. ♂ *red* and gray, ♀ gray and yellowish, uncrested. Bill *turgid*, hooked. (Boreal.) *Pinicola* 62
— under 8.00. — *Bluish-gray*, below reddish-gray, crown, wings, and tail black. (Alaska.) *Pyrrhula* 63
— *White*, with black on back, wings, and tail; or washed with clear brown. (Boreal.) *Plectrophanes* 72
— *Chocolate-brown*, unstreaked, with *rosy* edgings; black or clear *ash* on head. (Western.) *Leucosticte* 67
— *Streaky*; no yellow; ♂ extensively *red*; ♀ dark and white. Bill *turgid*. (E. and W. U. S.) . . . . . *Carpodacus* 65
— *Streaky*, with dusky or flaxen-brown and white; crown *crimson*. Bill *acute*. (Boreal.) . . . . . *Ægiothus* 68
— *Streaky* everywhere, *no* red or pure black, some *yellowish*. Bill *acute*. (N. Am.) *Chrysomitris* 70
— Streaky or *not*; much *yellow*, wings and tail *black*, *no* red. Bill moderate. (U.S.) *Astragalinus* 71
[Intermediate between Nos. 68 and 70] . . *Linota* 69
Bill *without* ruff; nostrils exposed.
Hind claw lengthened, *straightened*. — Bill *moderate*: ♂ with a colored *cervical collar*; oblique white on tail. (N. and W. N. A.) . . . . . *Centrophanes* 73
— Bill *turgid*; *no* cervical collar: transverse white on tail. (Western.) . . . . . *Rhynchophanes* 74
Hind and fore claws *lengthened*; all much curved; inner reaching at least ½ way to end of middle one —
— *Spotted and streaked* foxy or slaty sparrows, about 7.00 long. (N. Am.) *Passerella* 86
— Black, white and chestnut, *in masses*. (A Western species of) . . . . *Pipilo* 96
Hind and fore claws *not peculiar*.
Length 4.50 *or less*. — ♂ Black and white, ♀ olivaceous and yellowish. (Texas.) . . *Spermophila* 92
♂ Greenish blackening on head, ♀ greenish. (Florida.) . . . *Phonipara* 93
Length 7.50 *or more*. — Tail *longer than* wings. Plain brown, etc., or black, white, and chestnut. (U. S.) . . . . . *Pipilo* 96
— Tail *shorter than* wings. ♂ breast rose or orange; ♀ sulphur or saffron under wings (U. S.) . . . . . *Zamelodia* 89
Length *over* 4.50, *under* 7.50.
Colors *greenish* — with yellow — on edge of wing, and — 2 rufous crown-stripes. (Texas.) *Embernagra* 97
— Crown chestnut, breast ashy. (Western species of) . . . . . *Pipilo* 96
— on all under parts — no head markings. (♀ of a southern species of) . . . . . *Passerina* 91
Colors *not* greenish, and *not* extensively and decidedly spotted or streaked.
Black, with great *white* wing-patch; longest secondary about = longest primary. (Western.) . . . . . *Calamospiza* 87
Blue, with *chestnut* on wings, ♂; plain brown, ♀; over 6.00 long. (U. S.) *Guiraca* 90
Blue, with red, purple, gold, white, or not, ♂; brown, with white or not, ♀; under 6.00 long. (U. S.) . . . . . *Passerina* 91
Slate or ashy, red-backed or not, belly and 1-3 tail-feathers *white*. (N. Am.) *Junco* 82
Gray, throat and tail *black*, head with 2 white stripes, belly white. (Western.) *Amphispiza* 81
Colors *not* greenish, but somewhere or everywhere spotted or streaked.
Inner secondaries lengthened, about equalling primaries in the closed wing.
A large *white wing-patch*. Upper parts much streaked. (♀ of) . . *Calamospiza* 87
Bend of wing *chestnut*; outer tail-feather *white*; *no* yellow anywhere. (N. Am.) *Poœcetes* 76
No white or chestnut area on wing, its edge (usually) *yellowish*. (N. Am.) *Passerculus* 75

Inner secondaries *not* enlarged ; wing *decidedly* longer than tail.
Edge of wing and loral spot *yellow ;* breast buff; wing under 2.50. (Eastern.) *Coturniculus* 77
With *yellow* on breast, edge of wing, over eye; *black* throat-patch or stripes. (Eastern.) . . . . . *Spiza* 88
No yellow ; head striped with black, white, and *chestnut ;* tail *black*, white-tipped. (Western.) . . . . . *Chondestes* 85
No yellow ; wings *white-barred ;* throat black, ♂. (*Imported.*) . . . . . *Passer* 64
Inner secondaries *not* enlarged ; wing not, or not *decidedly*, longer than tail.
Tail-feathers — very *acute ;* bill — very slender.. (Eastern, chiefly maritime.) *Ammodramus* 78
— very *stout.* (Eastern, interior.) . . *Coturniculus* 77
— *not* acute ; tail — *forked.* Length 6.00 or less ; *no* yellow on wing. (N. Am.) . . . . . *Spizella* 83
— rounded — *black ;* edge of wing yellowish. (Western.) . . . . . *Amphispiza* 81
— not black. — Streaked below, or crown chestnut. (N. Am.) . . *Melospiza* 79
— not streaked below. (S. and W. U. S.) . *Peucæa* 80
or (N. Am.) *Zonotrichia* 84

*** The commonest "sparrows" of Eastern U. S., which the student will be most likely to find first, belong to the genera *Passer, Spizella, Melospiza, Zonotrichia, Passerella, Passerculus, Pœcetes, Coturniculus* (these anywhere); *Ammodramus* (marshes only); common but more distinguished fringillines are *Carpodacus, Astragalinus, Chrysomitris, Passerina, Spiza, Pipilo,* and *Cardinalis.* Winter visitors, in flocks, are *Loxia, Pinicola, Plectrophanes, Centrophanes, Ægiothus,* and *Junco.*

61. HESPEROPHO'NA. (Gr. ἑσπέρα. Hesperus, place of sunset ; φωνή, voice.) AMERICAN HAWFINCHES. Bill enormously large, vaulted, nearly as wide as high at base ; culmen nearly straight to the decurved end ; commissure curved without obvious angulation ; gonys very long, and mandibular rami short, not reaching back of base of upper mandible ; mandibles of equal thickness, lower not so deep as upper ; lateral outlines of bill converging straight to tip. Nasal fossæ extremely short and broad ; nostrils slightly overhung by antrorse plumulæ. Wings long, pointed, folding beyond middle of tail, pointed by first two primaries, the rest rapidly graduated ; no peculiar shape of inner primaries or outer secondaries. Tail rather short, emarginate, with long coverts, the under reaching nearly to the forking. Feet small and weak ; tarsus shorter than middle toe without claw ; lateral toes of about equal lengths, their claws reaching only to base of middle claw. Coloration black, white, and yellow. Sexes dissimilar. Little different from Old World *Coccothraustes*, excepting coloration and simplicity of wing-quills.

FIG. 206. — Evening Grosbeak, reduced. (Sheppard del. Nichols sc.)

189. H. vesperti'na. (Lat. *vespertina*, of Hesperus. FIG. 206.) EVENING GROSBEAK. Adult ♂ : General color sordid yellow, overlaid with a sooty-olive shade, deepest on fore parts, quite black on crown, clearest below behind. Forehead and line over eye, scapulars, and rump, yellow. Wings and tail black ; several inner secondaries and inner half of the greater coverts white ; lining of wings black and yellow. A narrow black line around base of upper mandible ; tibiæ black. Bill greenish-yellow ; feet apparently dusky flesh-color. Length 7.50–8.50 ; wing 4.00–4.50 ; tail 2.50–3.00 ; bill 0.75 long, 0.67 deep, 0.60 broad. ♀ : Brownish-ash, paler below, whitening on belly, irregularly patched or mixed with yellowish ; white of wings imperfect, or tinged with yellow ; primaries, which are quite black in ♂, with

large white spaces on inner webs, and sometimes tipped with white. Adult ♂ ♀ differ in the shade of yellow and degree of its obscuration. (Specimens from Southern Rocky Mts. said to have less turgid bill and narrower yellow frontlet.) A bird of distinguished appearance, whose very name suggests the far-away land of the dipping sun, and the tuneful romance which the wild bird throws around the fading light of day; clothed in striking color-contrasts of black, white, and gold, he seems to represent the allegory of diurnal transmutation; for his sable pinions close around the brightness of his vesture, as night encompasses the golden hues of sunset, while the clear white space enfolded in these tints foretells the dawn of the morrow. Western U. S. and somewhat northward; E. in region of great lakes to N. Y. and Canada and probably New England; irregularly migratory; common. Nest and eggs unknown.

62. PINI'COLA. (Lat. *pinus*, a pine; *colo*, I cultivate.) PINE BULLFINCHES. Bill short, stout, about as high as broad, sides convex in all directions, culmen convex throughout, tip hooked; commissure gently curved throughout, without decided angulation; gonys relatively long, rami of under mandible short, former nearly straight, latter coming together in a very broad gentle curve; commissural edge inflected. Nostrils small, round, basal, concealed by the ruff of antrorse plumules; nasal fossæ short and broad. Wings of moderate length, tipped by 2d-4th quills, 1st and 5th a little shorter; 2d–5th with outer webs incised; no peculiarity of inner quills. Tail little shorter than wings, emarginate, its short coverts scarcely or not reaching half-way to end. Feet small; tarsus not longer than middle toe without claw, 7-scutellate in front, laminiplantar behind, but the outer of these plates commonly subdivided into 3 or 4 below! Lateral toes short, their claws scarcely surpassing base of middle one, outer rather longer than inner; hind toe less in length than inner lateral; its claw shorter, though stouter and more curved than the middle. Sexes unlike; ♂ red, ♀ gray. One species.

190. P. enuclea'tor. (Lat. *enucleator*, one who shells out. Fig. 207.) PINE GROSBEAK. Adult ♂: Light carmine or rosy-red, feathers of back with dusky centres; lower belly and under tail-coverts gray, and, in general, the red continuous only in highly plumaged specimens. Nasal tufts and lores blackish. Wings blackish; primaries with narrow white or rosy edging, inner secondaries more broadly edged with white, ends of greater and middle coverts white or rosy, forming conspicuous wing-bars. Tail like wings, with narrow edgings like those of primaries. Bill blackish, with or without paler base below; feet blackish. Length about 8.50; wing 4.50 or more; tail 4.00. ♀: Ashy-gray, paler below; feathers of the back with darker centres, those of head, rump, and fore parts generally skirted with a saffron or yellowish color, very variable in extent and tint, from dull gamboge-yellow to olive-orange, or rusty-orange, or even reddish; in some specimens crown and rump quite bricky-red. Throat sometimes abruptly paler than surrounding parts. Rather smaller than ♂. Young ♂ resembles ♀. Northern portions of both hemispheres; in America, in summer, Alaska, British America and N. border of U. S., the Rocky Mts. to Colorado, and Sierra Nevada to Califoruia; in winter, range extended sometimes to Maryland, Ohio, Illinois and Kansas. Inhabits chiefly coniferous woods, in flocks when not breeding, feeding upon the fruit of such trees. A fine musician, of amiable disposition and gentle manners, often caged. Nest composed of a basement of twigs and rootlets, within which is a more compact fabric of finer materials; eggs usually 4, pale greenish-blue, spotted and blotched with dark brown surface-markings and lilac shell-spots; 1.05 × 0.74.

FIG. 207. — Pine Grosbeak, reduced. (Sheppard del. Nichols sc.)

63. **PYR'RHULA.** (Lat. *pyrrhula*, a bullfinch.) BULLFINCHES. Generic characters of *Pinicola* as above given; the lesser hook of the bill and different style of coloration being the principal distinction. Colors in masses of black, white or gray, and red.

191. **P. cas'sini.** (To John Cassin. Fig. 208.) CASSIN'S BULLFINCH. Above, clear ashy-gray; below, cinnamon-gray; rump and under wing- and tail-coverts white; wings and tail, crown, chin and face black; outer tail-feathers with a white patch, greater wing-coverts tipped and primaries edged with whitish; bill black, feet dusky. Length 6.50; wing 3.50; tail 3.25. Nulato, Alaska, only one specimen known, marked ♂, but having all the characters of a ♀; nearest related to *P. coccinea* of Asia, and originally described as a variety of that species.

FIG. 208. — Cassin's Bullfinch, reduced. (From Baird.)

64. **PAS'SER.** (Lat. *passer*, a sparrow: this very species.) SPARROWS. Form stout and stocky. Bill very stout, shaped somewhat as in *Carpodacus*, but without nasal ruff. Culmen curved; commissure little angulated; gonys convex, ascending; lateral outlines of bill bulging to near the end. Wing pointed; 1st, 2d, and 3d primaries nearly equal and longest; 4th little shorter, rest graduated; inner secondaries not elongate. Tail shorter than wings, nearly even. Feet small; tarsus about equal to middle toe and claw; lateral toes of equal lengths, their claws not reaching to base of middle claw. Sexes unlike. ♂ with black and chestnut on head. Middle of back only streaked. Old World: two species naturalized in North America.

192. **P. domes'ticus.** (Lat. *domesticus*, domestic. Fig. 209.) THE SPARROW. PHILIP SPARROW. HOUSE SPARROW. PARASITE. TRAMP. HOODLUM. GAMIN. ♂, adult: Upper parts ashy-gray; middle of back and scapulars boldly streaked with black and bay. A dark chestnut or mahogany space behind eye, spreading on side of neck. Lesser wing-coverts deep chestnut; median tipped with white, forming a conspicuous wing-bar, bordering which is a black line. Greater coverts and inner quills with central black field bordered with bay. Tail dusky-gray, unmarked. Lower parts ashy, gray or whitish; chin and throat jet black, spreading on the breast and lores, bordered on side of neck with white. Bill blue-black; feet brown. Wing about 3.00; tail 2.25. ♀, adult: Above, brownish-gray; streaking of back light ochrey-brown and black; wing-edgings light ochrey-brown, the white bar impure. No black, mahogany, or white on head; a pale brown postocular stripe; bill blackish-brown, yellowish at base below. Varies endlessly in the purity or dinginess of coloration. Young ♂ at first like ♀. Europe, etc. Imported about fifteen years ago, during a craze which even affected some ornithologists, making people fancy that a granivorous conirostral bird would rid us of insect-pests, this sturdy and invincible little bird has overrun the whole country, and proved a nuisance without a redeeming quality. Well-informed persons denounced the bird without avail during the years when it might have been abated, but further protest is futile, for the sparrows have it all their own way, and can afford to laugh at legislatures, like rats, mice, cockroaches and other parasites of the human race which we have imported. This species, of all birds, naturally attaches itself most closely to man, and easily modifies its habits to suit such artificial surroundings; this ready yielding to conditions of environment, and profiting by them, makes it one of the creatures best fitted to survive in the struggle for existence under whatever conditions man may afford or enforce; hence it wins in every competition with native birds, and in this country has as yet developed no counteractive influences to restore a disturbed balance of forces, nor any check whatever upon its limitless

increase. Its habits need not be noted, as they are already better known to everyone than those of any native bird whatever.

193. T. monta/nus. (Lat. *montanus*, of mountains. Fig. 209.) MOUNTAIN SPARROW. Somewhat like the last, but smaller and otherwise different. ♂: Crown and nape a peculiar purplish-brown. Lores, chin, and throat black, the throat-patch narrow and short, not spreading on breast, contrasted with ashy-white on side of head and neck; ear-coverts blackish. Back

FIG. 209.—Exotic Sparrows. Lowest one, *P. domesticus;* next one, *P. montanus;* reduced. (From Brehm.)

and scapulars streaked with black and bay, the streaking reaching to the purplish nape; rump and tail plain grayish-brown. Wings marked much as in *P. domesticus*, with a black and white bar across tips of median coverts, but also a narrow white bar across tips of greater coverts. Primaries more varied with ochrey-brown on outer webs, forming a basal spot and other edging. Below, ashy-gray, shaded on sides, flanks, and crissum with grayish-brown. Bill blue-black; feet brown. Wing 2.75; tail 2.50. ♀ differs much as before. Europe; naturalized about St. Louis and elsewhere.

65. **CARPODACUS** (Gr. *καρπός*, *karpos*, fruit; *δάκος*, *dakos*, biting.) PURPLE BULLFINCHES. Bill smaller and less upright than in *Fringilla* or *Pyrrhula*, more regularly conic and more acute; sides convex in all directions, but with distinct ridge prolonged in a point on forehead where not concealed by the antiæ, its outline moderately curved; commissure decidedly angulated, about straight before and behind the angle; gonys quite straight. Nasal ruff little developed, barely concealing the slight nasal fossæ, thence falling over sides of bill, but not continuous across culmen. Wings long and pointed, folding half-way to end of tail or farther, pointed by first 3 or 4 quills. Tail much shorter than wings, considerably forked, with rather narrow feathers; both sets of coverts reaching more than half-way to end. Feet small and weak; tarsus shorter than middle toe; lateral toes subequal, outer rather longer than inner, their claws reaching base of middle claw. Sexes unlike. ♂ extensively red of some shade, ♀ streaky brown and white. Head with erectile feathers, but not fairly crested. A beautiful genus, of several species of New and Old World.

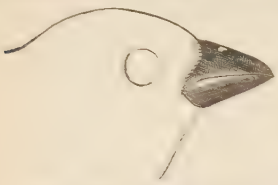

FIG. 210. — Bill of Purple Finch, nat. size.

Analysis of Species (♂).

Bill conic-acute, with scarcely convex culmen; edgings of wing- and tail-feathers reddish.
- Large; length 6.50–7.00; bill at least 0.50 along culmen. Under tail-coverts streaked with dusky centres of the feathers. Crimson crown well distinguished from merely reddish-brown back. (Southwestern U. S.) . . . . . *cassini* 195
- Medium; length 5.75–6.25; bill not 0.50 along culmen. Under tail-coverts scarcely or not streaked. Crimson of crown not well distinguished from that of back. (U. S.) . . . . . *purpureus* 194

Bill conoid-obtuse, with very convex culmen. Edgings of wing- and tail-feathers whitish.
- Small; length scarcely 6.00; bill about 0.40 along culmen. Front, line over eye, rump and throat red, more or less intermixing with brown or white of other parts.
  - Red pretty definitely restricted to the areas said (Southwestern U. S.) . . . . . *frontalis* 196
  - Red spreading over other parts (Californian coast) . . . . . *rhodocolpus* 197

194. C. purpu'reus. (Lat. *purpureus*, purple. Figs. 210, 211.) PURPLE FINCH (better CRIMSON FINCH.) Adult ♂: Rose-red, paler below, insensibly whitening on belly and crissum, brightest anteriorly, intensified to crimson on crown, darker and more brownish-red on back, where also streaked with dark brown. Wings and tail dusky, the quills edged and coverts tipped with brownish-red. Lores and feathers about base of bill hoary-whitish. Bill and feet brown, the under mandible rather paler. Length 6.00–6.25; extent 10.00–10.60; wing 3.00–3.25; tail 2.25–2.50; tarsus 0.62; middle toe and claw 0.87; bill under 0.50. The shade of red is very variable, almost anything but purplish — according to season, and age and vigor of the individual. In high feather, the crown is richer crimson than any other part, but does not form a definite cap. The auriculars are dusky, and there is an appreciably light rosy stripe over them. Younger ♂ ♂ have frequently a bronzy shade. ♀ and young: Olivaceous-brown, more clearly olivaceous on rump, everywhere streaked with dusky. Below, white, marked everywhere except on throat, belly, and crissum with streaks and arrow-heads of dusky olive-brown; the latter pretty evenly distributed on breast, former the same on sides, on the sides of neck and throat confluent and gathered into a maxillary series running up to the bill, separated by a poorly-defined whitish area from the olive-brown auriculars, over which is a whitish postocular streak. Wings and tail as in ♂, but the edgings plain brown. Length 5.70–5.90; extent

FIG. 211. — Purple Finch, ♂, reduced. (Sheppard del. Nichols, sc.)

9.50–10.00; wing about 3.00. Young ♂ cannot be certainly distinguished from ♂; in general, duller and grayer brown, with less of the olive shade; the red first shows pale or bronzy in slight touches. Cage-birds sometimes turn yellowish after moulting, as is the case with various other red finches. U. S. from Atlantic to Pacific, excepting probably the Southern Rocky Mt. region; N. to Labrador and the Saskatchewan. Breeds from the Middle States northward; winters in most of the U. S., particularly the M. and S. States. An engaging bird, of bright colors and sweet song, and many amiable traits, among them its fondness for the society of man; it comes fearlessly about our houses to build its own, which is generally situated on a horizontal bough or fork, composed of the most miscellaneous materials, almost any vegetable fibre being available for the flat and shallow structure; it is usually lined with hair, and the eggs, to the number of 4 or 5, are pale dull greenish, or almost whitish, sparsely sprinkled and scratched with blackish surface-markings and lilac shell-spots; size about 0.85 × 0.65; two broods are often reared. When not breeding the birds are generally found in flocks, and it is to be feared they do damage in the spring to the blossoms of fruit-trees.

195. C. cassi'ni. (To John Cassin.) CASSIN'S PURPLE FINCH. Adult ♂: In highest plumage duller than *C. purpureus*, excepting on crown. Middle of the back brown, tinged with red, the feathers dusky-centred, gray-edged; crown crimson, the cap not so extensive as in *purpureus*, and quite well defined, separated by a dusky and gray interval from the color of the back. Under tail-coverts with dusky shaft lines, usually wanting in *purpureus*. Larger: length 6.50–7.00; extent 11.00–11.50; wing 3.50; tail 2.50; bill at least 0.50 along culmen, usually more, relatively less turgid than in *purpureus*. Iris brown; feet blackish-brown; bill above dark bluish horn-color, below dusky flesh-tinted. The sexual changes are the same as in the last species; it is not so easy to distinguish the ♀ and young ♂ from those of *purpureus*, but they are larger, with longer and less tumid bill, and more streaked on the crissum. Very young birds have an ochraceous or light rufous suffusion, especially noticeable on the under parts; the streaks are more numerous and diffuse. Rocky Mts. of U. S. and westward, especially the Southern Rocky Mt. region, as Utah, Nevada, Arizona, and New Mexico; N. to British Columbia; E. to Wind River mountains; S. to table lands of Mexico. Habits the same as those of the purple finch; eggs not fairly distinguishable.

196. C. fronta'lis. (Lat. *frontalis*, pertaining to the front.) CRIMSON-FRONTED FINCH. HOUSE FINCH. BURION. Adult ♂: Grayish-brown above, somewhat varied with darker centres and paler edges of the feathers, and for the most part tinged with red. Below dull white, streaked with dark brown, often tinged with red. Fore part of crown, superciliary line, rump, throat, breast and sometimes side of head, crimson. Wings and tail dark brown, with narrow pale edgings. Bill dusky-brown above, paler below; feet and eyes brown. Length about 6.00; extent scarcely 10.00; wing 3.00; tail 2.50; scarcely forked; tarsus 0.67; bill 0.40, very turgid, almost as in *Pinicola* or *Pyrrhula*. ♀: Like ♂, but without any red; upper parts more varied with darker centres and paler edges of the feathers, and entire under parts streaked like belly of ♂. Young ♂ resembles the ♀, but at an early age is browner, and apt to have buffy edgings of the wings. Colors of adult ♂ as variable as those of *purpureus* or more so. In winter, the red less intense and more diffuse, and may have a rosy or purplish tint, or be interrupted with grayish edgings of the feathers. Generally in the Colorado Valley, where the typical form is developed, the red is restricted to the parts said, but the constant tendency is to spread; the back and belly have usually in fact a tinge of red, and in some cases the whole head and fore parts are thus encrimsoned. U. S., rather southerly, from the Rocky Mts. to the interior ranges of California; Colorado, Utah, Nevada, Arizona, and New Mexico; abundant in those regions, and as familiar as a swallow or chip-bird, nesting in the streets and gardens, where its bright colors, hearty song, and sprightly ways make it a welcome visitor. The nesting is like that of the purple finch in essential particulars: the eggs are smaller, paler, and of more fugitive bluish tint, with the blackish sprinkling sparser; size 0.68 × 0.60 to 0.75 × 0.54.

197. C. f. rhodocol'pus. (Gr. ῥόδον, *rhodon*, the rose; κόλπος, *kolpos*, the breast.) ROSE-BREASTED FINCH. This alleged variety resembles the last; crimson tints more diffuse. Pacific coast region of California and southward.

66. LOXIA. (Gr. λοξός, *loxos*, crooked.) CROSS-BILLS. Bill metagnathous; both mandibles falcate, deflected to opposite sides, their points crossed (unique among birds). Upper mandible stout and broad at base, rapidly narrowing to the elongate, decurved, laterally deflected and overhanging tip, its sides nearly flat, culminal ridge well marked and very convex throughout; its base beset with a ruff of antrorse plumules concealing nostrils and nasal fossæ. Lower mandible with gonys very long, occupying nearly all the exposed part of the bill, convex throughout, the end of the mandible prolonged, curved upward and deflected to one side. Commissural line of either mandible curved in the opposite direction from its fellow. Mouth very narrow anteriorly, ample at base; tongue horny and concave at end; œsophagus with a large special crop, bulging to the right side. Wings long, pointed by tips of the first three primaries, rest rapidly graduated. Tail very short, only about ⅜ as long as the wing, emarginate and divaricate, covered nearly to the forking by the coverts both above and below. Feet small; tarsus shorter than middle toe without claw; covered with 3 or 4 large overlapping plates, and smaller ones above and below; the postero-lateral plates much broken up below. Lateral toes of subequal lengths, tips of their claws falling opposite base of middle claw. Hind claw about equal to its digit, longer; stouter, and more curved than the middle one. Form stout, thickset; neck short; head broad and flattened on top. Plumage soft and blended. Sexes dissimilar in color. ♂ red, ♀ brown with olive or yellowish tinge. There are several species of these singular finches, — finches in which not only the horny envelope of the beak, but the bony framework, and to some extent the ligaments and muscles acting upon it, are unsymmetrical. The structures concerned in what would appear to a fool to be a deformity constitute a handy tool for cracking nuts of some kinds and shelling out their kernels; it acts like a pair of cutting pliers, — pincers and scissors in one. Our two species inhabit the northern parts of America, coming southward in flocks in the fall; but they are also resident in northern and mountainous parts of the U. S., where they sometimes breed in winter. They are irregularly migratory according to exigencies of weather and food-supply; are eminently gregarious, and feed principally upon pine seeds, which they skilfully husk out of the cones with their curious bills.

FIG. 212. — White-winged Crossbill, reduced. (After Audubon.)

Analysis of Species.

Wings with two white bars. ♂ rosy-red; ♀ brownish-olive, streaked and spotted with dusky, the rump saffron-yellow . . . . . *leucoptera* 198

Wings without bars. ♂ bricky-red. ♀ as before, without wing-bars.

Bill small, about ⅜ of an inch long . . . . . *americana* 199

Bill large, ¾–⅞ of an inch long . . . . . *mexicana* 200

198. L. leucop'tera. (Gr. λευκός, *leukos*, white; πτερόν, *pteron*, wing. Fig. 212.) WHITE-WINGED CROSS-BILL. Adult ♂: Rosy-red, sometimes carmined or even crimsoned, obscured on middle of back, paling on lower belly and crissum, latter whitish with dusky centres of the feathers. Scapulars black, this color sometimes meeting across lower back. Wing- and tail-feathers black, with slight white or rosy edgings; inner secondaries and greater and middle coverts tipped with white, forming two cross-bars, sometimes confluent in one large patch. Rather

larger than the next, the bill thinner and more attenuate. ♀ and young: Though the differences are parallel with those of *L. americana*, some peculiarity in tone of color usually serves to distinguish the two species, independently of the white wing-marks, which exist in both sexes at all ages. The difference is something like that between the ♀♀ of *Pyranga æstiva* and *P. rubra*, in the presence of ochrey or buffy tints, instead of clear olivaceous or yellowish. Upper parts fuscous, closely lined with an ochrey-olive or dingy ochre, the rump bright yellow-ochre. Below, the gray overlaid with ochreous, and further varied with dark gray centres of the feathers, tending to streaks on the flanks. The whole tone of coloration varies interminably; the under parts and rump are sometimes bright tawny yellow, or brownish-orange. Some ♂♂ are brilliant carmine, some ♀♀ pale orange, almost uniform. North Am., northerly; Alaska; Greenland; casual in Europe. In winter S. in most of the U. S., in flocks with the next, not so common. Resident in N. New England, and along whole N. tier of States, probably breeding also in alpine U. S. localities to Pennsylvania and Colorado. Breeds in winter and early spring, nesting like that of the next species; eggs pale blue, dotted chiefly at the larger end with black and lilac; 0.80 × 0.56.

199. L. curviros'tra america'na. (Lat. *curvirostris*, curve-billed. Fig. 213.) American Red Cross-bill. Adult ♂: Red; wings and tail blackish, without white markings. Middle of back darker, more brownish-red than elsewhere, the feathers with dusky centres. In the highest feather, even, the red is scarcely continuous except on head and rump, where brightest; lower belly and crissum usually gray or pale. Though the shade of red is never rosy or carmine as in the last, it varies interminably. It is usually tile-red or cinnabar, heightening in some cases to vermilion, in others shading to brownish-red, and often mixed not only with gray, but with olivaceous or saffron-yellowish tints. Orange, chrome or gamboge ♂♂ are sometimes seen. Length about 6.00; wing 3.50; tail 2.50; bill (chord of culmen) 0.67 *or less*, very variable; under mandible usually weaker than upper. ♀ and young: Dull greenish-olive, much mixed with gray or dusky, brighter and more yellowish on head and rump; below, gray, most feathers skirted with dingy yellowish, overcasting most of the plumage. Very young are dusky, streaked with grayish-white, usually no trace of olivaceous; below gray, streaked with dusky; bill weak. From such state as this the ♂ usually passes through stages resembling the ♀, being found in every possible patchy state of mixed gray, olive and dusky-reddish; sometimes appears to pass directly into the red state, and the same is doubtless the case with other species. N. Am., alpine and northerly; S. in most of the U. S. in winter, on the E. side usually to Pa. and Md.; resident in Maine, in mountains S. to Pa., and in the Rocky and other Mts. of the West; abundant, in gentle and unwary but timid flocks, usually including some individuals of the other species, fluttering and creeping about in the foliage of coniferous trees. Nesting often in winter or early spring when snow still covers the ground; nest in forks or among twigs of a tree, founded on a mass of twigs and bark-strips, the inside felted of finer materials, including small twigs, rootlets,

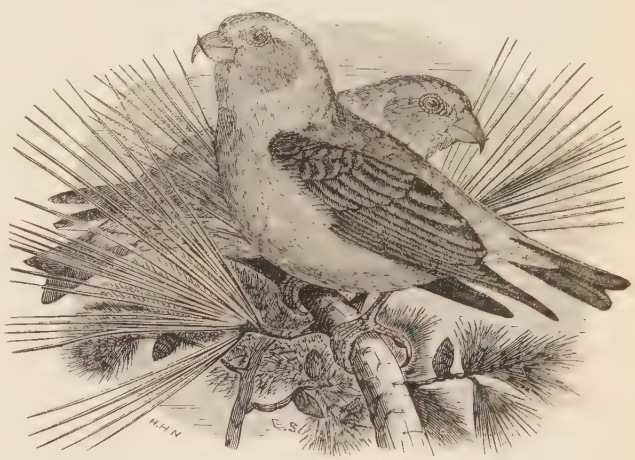

Fig. 213. — Common Crossbill, ♂♀, reduced. (Sheppard del. Nichols sc.)

grasses, hair, feathers, etc.: eggs 3–4, 0.75 × 0.57, pale greenish, spotted and dotted about larger end with dark purplish-brown, with lavender shell-markings.

200. **L. c. mexicana.** MEXICAN CROSS-BILL. Like the last; the bill larger, 0.75 or more long, the under mandible especially more robust. Southern Rocky Mts. and southward on the table lands of Mexico.

67. **LEUCOSTICTE.** (Gr. λευκός, *leukos*, white: στικτή, *sticte*, varied. Fig. 215.) ROSY FINCHES. Bill small, conic-acute, ruffed at base with antrorse plumules meeting over culmen and concealing the short nasal fossæ and small nostrils. Side of under mandible (in typical species) with a sharp ridge running obliquely upward and forward. Culmen ridged between two slight depressions parallel with itself, gently convex throughout. No obvious angulation of commissural edge of upper mandible: that of lower with decided bend; gonys straight. Wings long, folding beyond middle of tail, tipped by first 3 primaries, 4th shorter. Tail of moderate length, forked, its feathers rather broad, its coverts reaching about ½ way to end. Tarsus not shorter than middle toe without claw; lateral toes unequal, inner shorter, its claw not reaching base of middle claw. Hind claw about as long as its digit, more curved and longer than middle claw. Sexes somewhat dissimilar. Coloration peculiar; usually chocolate-brown, enriched with rose or carmine, shaded with silvery-gray or black; one species mostly silvery-gray. The American representative of the Old World genus *Montifringilla*. Terrestrial, highly gregarious; nest on ground; eggs immaculate white. Numerous species of this very interesting genus are scarcely stable; I present the forms that are usually recognizable. The nearest American relative is *Ægiothus;* the general economy is more that of *Plectrophanes*.

Analysis of Species.

Under mandible ridged. Body-color chocolate-brown or darker.
- No ash on head (Colorado) . . . . . *australis* 202
- Ash on head confined to the top.
  - Coloration blackish (Colorado) . . . . . *atrata* 201
  - Coloration chocolate (W. America) . . . . . *tephrocotis* 203
- Ash spreading on sides of head
  - Smaller: wing 4.20. (W. America) . . . . . *litoralis* 204
  - Larger: wing 4.60. (Alaska) . . . . . *griseinucha* 205

Under mandible smooth.
- Dusky-purplish and silvery-gray, with rosy . . . . . *arctoa* 206

201. **L. atrata.** (Lat. *atrata*, blackened.) RIDGWAY'S ROSY FINCH. Sexes unlike. ♂, in April: Pattern of coloration and distribution of tints as in *tephrocotis* proper (see beyond); nasal tufts white, and occiput ashy, as in that species, but the chocolate-brown of *tephrocotis* replaced by black, deepest anteriorly and on under parts, sooty-brownish on the back. Bill black (April) or yellow (September). Size of *tephrocotis*. ♀, in April: Black of ♂ represented by dark slate-gray, more brownish on back, the rosy markings duller and more restricted; size rather less. This form occurs in the mountains of Colorado and Utah. We know neither the summer nor winter plumage of this bird; no winter plumage nor whereabouts of *australis;* nor young nor breeding plumage of *tephrocotis;*—points to be ascertained before we can decide the *status* of several alleged species of the genus.

202. **L. australis.** (Lat. *australis*, southern.) ALLEN'S ROSY FINCH. Sexes unlike. ♂, breeding plumage: Rich chocolate or umber-brown, the feathers of the back with darker shaft-lines and paler edges, those of the under parts darker and somewhat purplish-brown. Red parts of the body heightened to intense crimson, extending farther forward than in *tephrocotis*, sometimes skirting all the feathers of the under parts; especially strong on the wing- and tail-coverts and belly. No pure ash whatever on head; whole pileum black or blackish, purest anteriorly, duller behind. Nasal tufts white. Bill and feet black. Length 6.75; wing 4.00–4.40, averaging in 69 specimens 4.30; tail 2.80–3.35, average 3.10; bill 0.45; tarsus 0.75. When not in highest feather, carmine toned down to more pink or rosy. In winter, bill yellow, changing to black through various cloudings. ♀, in summer: While generally like ♂, having black

bill and no ash on head, averages a little smaller, and is much duller colored; brown parts of a grayish cast; rosy reduced or almost extinguished, chiefly traceable on rump and wing-coverts; abdomen scarcely tinted, and quills and tail-feathers with whitish instead of rosy edgings. Wing 4.00–4.20, averaging little over 4.00; tail 2.90–3.25, average 3.00. Colorado and New Mexico, breeding up to 12,000 feet; a curious southerly local race of the genus.

203. L. tephroco'tis. (Gr. τεφρός, *tephros*, gray; οὖς, ὠτός, *ous*, *otos*, the ear. Fig. 214.) Swainson's Rosy Finch. Sexes similar. Adult ♂, in breeding plumage or nearly so: Bill and feet black. Nasal plumules white. Frontlet black; rest of pileum hoary-ash, *not* descending below level of eyes and upper border of auriculars (for when the ash invades the sides of head to any extent, the bird takes the first step toward *litoralis*, in which the head is extensively hooded in ash). General color, sides of head included, chocolate or liver-brown of varying intensity, many feathers skirted with gray or whitish, especially the interscapulars, which also have dusky centres, and inclining to blackish on chin and throat. Hinder parts of the body above and below, including tail-coverts, rich rosy or carmine red, this color due to broad edgings of the dusky feathers of these parts. Wings and tail blackish, the wing-coverts and primaries edged with rosy, showing nearly continuous in the closed wing; edgings of inner secondaries rosy-white or white. Length (average) 6.75; wing 4.00–4.45, average 4.25; tail 2.50–3.00, average 2.75; culmen 0.40–0.50, average 0.45; tarsus 0.75–0.85, average 0.80. ♀, adult: Very similar; pattern identical; tone subdued; size a little less; length 6.60; wing 4.10; tail 2.65. ♂ ♀ in winter: Bill yellow; pattern unchanged; coloration less vivid, the brown rather umber than chocolate, the red rather rosy than carmine. Rocky Mt. region, from the Saskatchewan or beyond, through most of the U. S. in winter; breeding limits unknown, supposed to be Northern Rocky Mts. of U. S. and beyond. This is the central figure in the genus. It runs directly into

Fig. 214. — Rosy Finch, reduced. (Sheppard del. Nichols sc.)

204. L. t. litora'lis. (Lat. *litoralis*, littoral.) Baird's Rosy Finch. Like the last; the ash spreading over the head, more or less, sometimes almost enveloping it like a hood, and even occupying the chin in extreme cases. Size of the last. Northwest coast; in summer unknown, in winter spreading from Kadiak S. and E. to California, Nevada, Utah, and Colorado; very abundant, in flocks mixed with *tephrocotis* proper.

205. L. griseinu'cha. (Low Lat. *griseus*, gray, and *nucha*, nape. Fig. 215.) Brandt's Rosy Finch. Like the littoral variety of *tephrocotis*, in having the ashy extending over the sides of the head; this color settled in a definite hood, said to never invade the chin. The resident form of the N. W. coast and islands, from Kadiak W. and N. Much larger than Nos. 203–4; length 7.00 or more; wing 4.50 (4.25–4.85); tail 3.50 (3.15–3.90); culmen 0.57; tarsus 0.95. Sexes scarcely distinguishable. Bill black or yellow according to season. Young "uniform brownish-gray, washed with umber; wings and tail dusky-slate, the feathers bordered with paler; the edges of the lesser wing-coverts and remiges very pale pinkish; of the greater wing-coverts and tertials pale dull ochraceous; no black or gray about head; bill horn-color." Nest well made of grasses and mosses, lined with feathers, on the ground or among rocks; eggs 3–6, generally 4, pure white, 0.97 × 0.67.

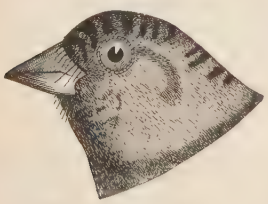

Fig. 215. — Brandt's Rosy Finch. (After Baird.)

206. L. arcto'a. (Gr. *ἀρκτῷος, arktoios*, northern.) PALLAS'S ROSY FINCH. Dusky-purplish; neck above pale yellowish; forehead and nasal feathers blackish; outer webs of quills and wing-coverts, tail-coverts, rump and crissum silvery-gray, rosy-margined. Kurile and Aleutian Islands; Siberia. Subgenerically different from any of the foregoing.

68. ÆGI'OTHUS. (Gr. *Αἰγίοθος*, nom. propr. Fig. 216.) RED-POLL LINNETS. Bill small, short, straight, very acute, more or less compressed, the lateral outlines usually a little concave, those of culmen and gonys straight; commissure straight to the slight angulation. Base of bill thickly beset with a ruff of antrorse plumules, concealing the small nasal fossæ and round nostrils. Wings longer than tail, pointed by first 3 primaries. Tail rather long for this group, forked. Feet small and weak, but tarsi longer than middle toe without claw; lateral toes of equal lengths, their claw-tips falling beyond base of middle claw. Hind claw much longer, stouter and more curved than the middle, exceeding its digit in length. Size small; plumage streaky with dusky, white, and flaxen colors, crown crimson, face and throat blackish; sexes otherwise dissimilar; ♂ with rosy or carmine on breast, wanting in ♀. Scarcely different from *Linota* (*flavirostris*, etc.) the pattern of coloration being the most available distinction. Arboreal, gregarious, highly boreal finches of circumpolar distribution, breeding in high latitudes and alpine regions, roving south in winter in great flocks. The species are much involved; we have four recognizable forms.

FIG. 216. — Details of *Ægiothus* (*Æ. hornemanni*, nat. size). (From Elliot.)

Analysis of Species.

Tarsus as long as middle toe and claw. Heavily streaked below. Rump always fully streaked.
- Smaller: length about 5.50; wing 3.00; bill moderate (N. Am. at large) . . . . . *linaria* 207
- Larger: length about 6.00; wing 3.25; bill immoderate (Canada, etc.) . . . . . *holboelli* 208

Tarsus longer than middle toe and claw. Lightly or scarcely streaked below. Rump of adult ♂ immaculate white to some extent.
- Smaller: length about 5.50; wing 3.00. Bill and feet small (Brit. Am., scarcely U. S.). . . *exilipes* 210
- Larger: length about 6.00; wing 3.30. Bill and feet large (Greenland) . . . . . *hornemanni* 209

207. Æ. lina'ria. (Lat. *linaria*, flaxen; a linnet. Fig. 217.) COMMON RED-POLL. Adult ♂: Frontlet, lores, and throat-spot sooty-black. Crown crimson. Above, variegated with brownish-yellow and dusky, the feathers having dark centres and flaxen edges. Rump streaked with dusky and white, and tinged with rosy, more or less so according to age and season. Below, white, the sides and crissum streaked with dusky, the entire fore-parts colored with rose-red more or less rich and extensive according to same circumstances. Wings and tail dusky, the feathers edged with whitish, the middle and greater coverts tipped with the same, forming two cross-bars. Bill black or yellow, usually found yellow with dusky tip and edges. Feet blackish. Length 5.50; extent 9.00; wing 3.00; tail 2.50; bill 0.33; tarsus 0.65; middle toe and claw the same. Adult ♀: Wanting entirely or having but a trace of rosy on the rump and under parts. Breast with a dingy yellowish wash, streaked with dusky. Slightly smaller. Young: Like ♀, but the ♂ soon showing rosy. Young may usually be distinguished from the adult ♀ by

FIG. 217. — Common Red-poll, reduced. (Sheppard del. Nichols sc.)

a general buffy suffusion, especially on fore parts; edgings of wing likewise buffy; streaks below less sharply defined; crimson of crown restricted, or of a coppery or bronzy tint. In worn midsummer plumage the bird is very dark colored, almost entirely dusky. This bright little bird inhabits northerly parts of both hemispheres, irregularly south in winter in N. Am. to about 35°; at times abundant, but erratic. Eggs 4–5, very pale bluish, finely speckled all over with reddish-brown, 0.65 × 0.52. Nest in low trees and bushes.

208. **Æ. l. hol'boelli.** (To C. Holböll, a Danish naturalist.) Holböll's Red-poll. Like the last; larger; length 6.00 or more; wing 3.25; tail 2.75; bill longer and less constricted, with straight lateral outlines and rather curved culmen. Europe and N. Am., especially Canada and New England.

209. **Æ. hor'nemanni.** (To J. W. Hornemann. Fig. 216.) Greenland Mealy Red-poll. Bill regularly conic, only moderately compressed and acute, as high at base as long, color varying with season from black to yellow. Frontlet black, overlaid with hoary. A recognizable light superciliary stripe, reaching to the bill. Crimson cap over nearly all the crown. Upper parts streaked with brownish-black and white, the latter edging and tipping the feathers; this white nearly pure, only slightly flaxen on sides of head and neck. Wings and tail as in other species. Rump and entire under parts from the sooty throat white, free from spots, the rump and breast rosy. Feet large and stout; tarsus rather longer than middle toe and claw. Length 6.00; wing 3.30; tail 2.80; bill 0.34; tarsus 0.65; middle toe and claw 0.58. Sexual and seasonal changes as before; quite dark in midsummer. Greenland and N. Europe. This large hoary northern form is resident; never known to occur in the U. S., and most of the continental Red-polls of even Arctic N. Am. belong to the next species.

210. **Æ. exi'lipes.** (Lat. *exilis*, exiguous, small; *pes*, foot.) American Mealy Red-poll. Bill small, short, stout at base, regularly conic, little compressed, all its outlines about straight; nasal plumules very heavy, sometimes reaching half-way to tip of bill. Frontlet dusky, but the feathers tipped with hoary; an appreciable light superciliary line; lores and throat-spot dusky. General color of upper parts as in *linaria*, but the dusky streaks are smaller and less distinct, especially on the anterior parts; and the flaxen is very pale, nearly white, disappearing entirely on lower back, leaving a space streaked only with dusky and white. Rump snowy-white, rosy-tinted, immaculate. Wings and tail as in other species; under parts white, the breast with a rosy tint, paler than in *linaria* of same age and season; the sides streaked with dusky, the markings sparser and less definite than in *linaria;* crissum almost immaculate. Feet very small and weak, the toes especially shorter. Length 5.50; extent 9.00; wing 3.00; tail 2.50; tarsus 0.55; middle toe without claw 0.28; middle toe and claw shorter than tarsus; bill 0.32. Seasonal and sexual differences as before. This form inhabits the whole of boreal America, seldom reaching the U. S. and only along the northern tier of States.

69. **LINO'TA.** (Latinized from Fr. *linotte*, a linnet.) Linnets. Character of *Ægiothus* in form; no crimson crown. European.

211. **L. flaviros'tris brew'steri?** (Lat. *flavirostris*, yellow-billed. To Wm. Brewster, of Cambridge.) Brewster's Linnet. With the general appearance of an immature *Ægiothus*, this bird will be recognized by absence of crimson on crown, no black throat-spot, a sulphur-yellowish shade on lower back, and somewhat different proportions. Wing 3.00; tail 2.50; tarsus 0.50. Massachusetts, one specimen known. (*Ægiothus flavirostris*, var. *brewsteri*, Ridg., Am. Nat., vi, July, 1872, p. 433; Hist. N. A. B., i, 1874, p. 501. Conjectured to be *Ægiothus linaria* × *Chrysomitris pinus*.)

70. **CHRYSOMI'TRIS.** (Gr. χρυσομίτρις, *chrusomitris*, having a golden head-dress.) Siskins. Bill exceedingly acute; its lateral outlines concave by compression of the sides toward the end, culmen and gonys about straight, commissure angulated, cutting edges inflected, no ridges on either mandible. Nasal tufts concealing the nostrils in their short fossæ. Wings long, exceeding the short, emarginate tail; point formed by the 1–3 or 4 quills, 5 and rest rapidly

shorter. Tarsus about as long as middle toe with claw; lateral toes of equal lengths, their claws reaching base of middle claw; hind claw shorter than its digit. Everywhere thickly streaked. No red. Sexes alike. Habit gregarious. Nest in trees. Eggs speckled.

212. C. pi'nus. (Lat. *pinus*, a pine. Fig. 218.) PINE LINNET. PINE FINCH. AMERICAN SISKIN. ♂ ♀, adult: Continuously streaked, above with dusky or dark olivaceous-brown and flaxen or whitish, below with dusky and whitish, the whole body usually suffused with yellowish, most evident on the rump. Wings dusky, the basal portion of all the quills and their inner webs for some distance sulphury-yellow, usually showing externally as a spot just beyond the coverts, sometimes restricted and hidden. Outer webs of the quills also narrowly edged with yellow, separated from the basal yellow patch by a blackish interval. Tail dusky, its basal half yellow, and outer webs edged with yellow. Bill and feet brown. Length about 4.75; extent 8.75; wing 3.75; tail 1.75. Very variable in yellowness of tone, sometimes quite bright, again plain streaky, dusky and whitish or flaxen; but the yellow coloration of the wings and tail is distinctive. Young birds have the markings diffuse, with a general buffy-brownish suffusion. N. Am. at large, breeding northerly, ranging in flocks in the winter through most of the U. S., abundant. Nest high in trees, preferably conifers; eggs pale greenish, speckled with brown; about 0.70 × 0.50. Flight undulatory; voice querulous.

FIG. 218. — Pine Finch, reduced. (Sheppard del. Nichols sc.)

71. ASTRAGALI'NUS. (Gr. *ἀστραγαλῖνος*, *astragalinos*, name of some bird.) AMERICAN GOLDFINCHES. Like *Chrysomitris*. Bill stouter, less acuminate, without extreme lateral compression, culmen rather convex, gonys quite straight; commissure strongly angulated; upper mandible usually showing longitudinal striæ. Nasal ruff evident, though short. Wings and tail as in *Chrysomitris;* feet smaller; toes shorter; lateral digits of unequal lengths; outer claw rather overreaching, inner not reaching, base of middle claw. Coloration massed, not streaky; yellow, olive, black and white, no red. Sexes unlike. Eggs white.

Analysis of Species

♂ yellow (in summer) with black cap, wings and tail, the two latter white-marked (Eastern)	*tristis*	213
♂ gray, varied with yellow on back, breast, and wings, with black face, wings, and tail, latter white-marked (Western)	*lawrencii*	214
♂ above olive or black, or mixed with both; yellow below; wings and tail black, white-marked (Western).		
Back olive; crown black, not below eyes: large white tail-spots	*psaltria*	215
Back mixed olive and black; crown black; moderate white tail-spots	*arizonæ*	216
Back and crown black, to below eyes; small white tail-spots	*mexicanus*	217
♂ yellow, with black yellow-spaced wings and tail, and whole head black. (Mexico, etc.)	*notatus*	218

FIG. 219. — American Goldfinch, ♂, in summer, reduced. (Sheppard del. Nichols sc.)

213. A. tris'tis. (Lat. *tristis*, sad; from its note. Fig. 219.) AMERICAN GOLDFINCH. YELLOW-BIRD. THISTLE-BIRD. ♂, in summer: Rich yellow, changing to whitish on the tail-coverts; a black patch on the crown; wings black, more or less edged with white; lesser wing-coverts white or yellow; greater coverts tipped with white; tail black, every feather with a white spot; bill and feet

flesh-colored. In September, the black cap disappears; the general plumage changes to a pale flaxen-brown above and whitey-brown below, with traces of the yellow, especially about the head; wings and tail much as in summer; sexes then much alike: this continues until the following April or May. Length 4.80–5.20; extent 8.75–9.25; wing 2.75; tail 2.00; ♀ olivaceous above, including the crown; below soiled yellowish, wings and tail dusky, whitish-edged; rather smaller than the ♂. Young like the winter ♀; when very young, suffused with fulvous, and the wings edged with tawny. N. Am., especially the Eastern U. S.; an abundant and familiar species, conspicuous by its bright colors, and plaintive lisping notes; in the fall, collects in large flocks, and so remains until the breeding season; irregularly migratory, but winters as far north as New England; feeds especially on the seeds of the thistle and buttonwood; flies in an undulating course. Nest small, compact, built of downy and other soft pliant substances, placed in a crotch; eggs 4–6, faintly bluish-white, normally unmarked, 0.65 × 0.50.

Fig. 220. — Lawrence's Goldfinch, reduced. (Altered from Audubon.)

214. A. lawren'cii. (To G. N. Lawrence, of New York. Fig. 220.) Lawrence's Goldfinch. ♂, in summer: Gray, more or less tinged with yellowish, whitening on the belly and crissum; rump, a large breast-patch, and much of the back rich yellow; crown, face, and chin black; wings black, variegated with yellow, most of the coverts being of this color, and the same broadly edging the quills; inner secondaries edged with hoary gray; tail black, most of the feathers with large square white spots on the inner webs and whitish edging of the outer; bill and feet flesh-color more or less obscured. The ♀ resembles the ♂, but there is no black on the head, and the yellow places are not so bright; yellow of the back often wanting. ♂ ♀, in winter: The yellowish of the upper parts changed to olive-gray, but the yellow of other parts often as bright as in summer, and the black of the ♂'s head the same. Size of *tristis*, or rather less; an elegant species. California, Arizona, and New Mexico. General habits the same as those of *C. tristis;* nest and eggs indistinguishable.

215. A. psal'tria. (Gr. ψάλτρια, *psaltria*, a lutist. Fig. 221.) Arkansaw Goldfinch. ♂, adult: Upper parts uniform olive-green, without any black; below yellow; crown black, this *not* extending below eyes; wings black, most of the quills and the greater coverts white-tipped, and the primaries white at base; tail black, the outermost three pairs of feathers with a long rectangular white spot on the inner web. ♀ and young similar, but not so bright, and no black on the head; sometimes, also, no decided white spots on the tail. Length 4.25–4.50; wing 2.30; tail 2.00. Plains to the Pacific, U. S., southerly; N. at least to the head-waters of the Platte. A pretty species, of the same habits as the common Goldfinch; nest and eggs the same. Southward this form passes directly into

Fig. 221. — Arkansaw Goldfinch, reduced. (After Audubon.)

216. A. p. arizo'næ. (Lat., of Arizona.) Arizona Goldfinch. The upper parts mixed olive and black in about equal amounts; thus leading directly into

217. A. p. mexica'nus. (Lat. Mexican. Fig. 222.) Mexican Goldfinch. The upper parts con-

tinuously-black, and the black of the crown extending below the eyes, enclosing the olive under eyelid. Mexican border and southward. This bird looks quite unlike typical *psaltria*, but the gradation through var. *arizonæ* is perfect; and *mexicana*, moreover, leads directly into var. *columbiana*, a Central American form in which the tail-spots are very small or wanting. The females of these several varieties cannot be distinguished with certainty.

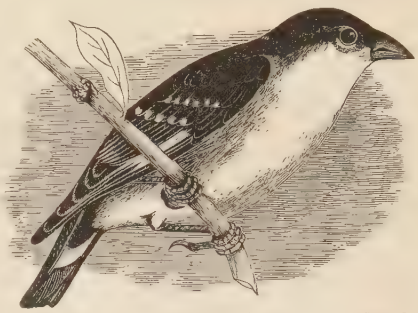

Fig. 222. — Mexican Goldfinch, reduced. (After Audubon.)

218. **A. nota/tus.** (Lat. *notatus*, noted in any way.) Black-headed Goldfinch. ♂, adult: Bright yellow, obscured on the back, head all around glossy black, extending on fore-breast; wings black, with large basal area on all the quills yellow, forming a conspicuous patch; tail black, basal half or more of all the feathers but the middle pair yellow. Wing 2.70; tail 1.80; bill extremely acute, much as in *Carduelis* or *Chrysomitris* proper. South and Central Am. and Mexico, a straggler in U. S. (? "Kentucky," *Audubon.*)

72. **PLECTRO/PHANES.** (Gr. πλήκτρον, *plectron*, a certain instrument; φαίνω, I appear; alluding to the hind claw.) Bill very small and truly conic, well exhibiting "emberizine" or "bunting" characters; i. e., strong angulation of commissure; inflected cutting edges; a palatal knob. Culmen slightly curved; gonys perfectly straight, and very short, less in length than width of bill; lower mandible heavier than upper. A dense nasal ruff. Wings very long and pointed; 1st or 1st and 2d quills longest, rest rapidly graduated. Tail ⅛ shorter than wings, nearly square. Tarsus longer than middle toe without claw; lateral toes of subequal lengths, and much shorter than the middle one. Claws slender and compressed, with deep lateral grooves at base; hind claw lengthened and less curved than the rest, but not straight. Gullet very distensible. Sexes alike. Colors very different with season; in summer ♂ entirely black and white. One species, circumpolar. Terrestrial, gregarious.

219. **P. niva/lis.** (Lat. *nivalis*, snowy; *nix*, *nivis*, snow. Fig. 223.) Snow Bunting. Snow-flake. ♂, in full dress: Pure white; the bill, feet, middle of back, scapulars, primaries except at base, most inner secondaries, bastard quills, and several tail-feathers, black. Length about 7.00; extent 12.50–13.00; wing 4.00–4.25; tail 2.50–2.75. In less perfect summer dress, black of the back, inner secondaries and tail-feathers varied with white. ♀, in breeding plumage: The black impure or brownish, and most or all of the upper parts brownish-black, varied with white. Rather smaller. Dimensions of many specimens of both sexes: length 6.50–7.00; extent 12.00–13.00; wing 4.00–4.25; tail 2.50–2.75; bill 0.40; tarsus 0.80; middle toe and claw 0.90; hind toe and claw 0.67–0.75; claw alone 0.33–0.44. Adults, in winter, as generally seen in the U. S. (where black-and-white birds are rarely if ever found): Upper parts overcast with rich warm chestnut-brown and grayish-brown, mixed with the black of the back, and clouding the other upper parts which are white in summer, becoming dusky or even blackish on the head; this brown also usually forming a patch on the ears, a collar on the breast, edging of the inner wing- and tail-feathers, and a wash on the flanks; but specimens vary interminably; other parts white or black as in summer; bill

Fig. 223. — Snow Bunting, in summer, reduced. (Sheppard del. Nichols sc.)

yellowish, usually black-tipped, but drying reddish-brown. Fledglings: Dark ashy-gray above, and on the fore parts below this color overlaid with brown, and streaked on the back with dusky; below, from the breast, white; lateral tail-feathers mostly white; inner secondaries black with brown edging. A very notable bird, inhabiting the northern hemisphere, breeding in arctic regions, whence migrating south in vast flocks with the snow, as if one with these pure crystallizations. Thousands whirl into the U. S. in the fall on the wings of the storm, relieving by their animated presence the desolation of places exposed to the fury of the blast. South regularly only to the Northern States, but often the roving flocks reach 35°. Nest on the ground in the sphagnum and tussocks of arctic regions, of a great quantity of grass and moss, lined profusely with feathers: eggs 4–6, very variable in size and color, about 0.90 × 0.65, white or whitish, speckled, veined, blotched, and marbled with deep browns and neutral tints.

73. **CENTRO'PHANES.** (Gr. *κέντρον, kentron*, nail, claw; *φαίνο, phaino*, I appear; the hind claw lengthened and straightened.) LONGSPURS. Characters of *Plectrophanes;* hind claw and its digit more developed; longer than the middle; bill relatively and absolutely larger, rather "fringilline" than thoroughly "emberizine," but still with a palatal knob; no decided nasal ruff, but antrorse plumules in nasal fossæ; a little tuft at base of rictus. Wings less acute, the point formed by 1st–3d primaries, 4th abruptly shorter; tail emarginate. Sexes very unlike: ♂ with a black hood and chestnut cervical collar. Gregarious, terrestrial.

Analysis of Adult Males.

Whole head and throat black; belly white; bill yellow; feet black	*lapponicus* 220
Crown black; whole under parts fawn-colored; feet flesh-colored	*pictus* 221
Crown black; throat white; belly black or mahogany; feet dark	*ornatus* 222

220. C. lappon'icus. (Lat. *lapponicus*, of Lapponia, Lapp-land. Figs. 43, 224.) LAPLAND LONGSPUR. ♂, in full dress (seldom seen in U. S.): Whole head, throat and breast jet-black, bordered with buffy or whitish, which forms a post-ocular stripe separating black of crown from that of sides of head, sometimes continued to the bill. A broad cervical chestnut collar, separated from the black cap by whitish or buffy line and nuchal spot. Upper parts brownish-black completely streaked with buff or whitish edges of the feathers; under parts white, the sides streaked with black. Wings dusky, with pale or brownish edgings of the feathers, but no strong markings. Tail like wings, with large oblique white spaces on outer 3 feathers. Bill yellow, black-tipped. Legs and feet black. Length about 6.50; extent 11.25; wing 3.50–3.75; tail 2.50–2.75; tarsus 0.75; middle toe and claw rather more; hind claw about 0.50, slender, sharp, and little curved. ♂, adult, in winter: The black hood overcast with brown or gray tips of the feathers, or otherwise imperfect. Chestnut collar also overlaid with gray. Edges of secondaries and wing-coverts ruddy-brown; sides of flanks washed with brown. White tail-spots less extensive. Yellow of bill obscured. ♀, in breeding plumage: Upper parts of body, wings and tail, as in ♂. No continuous pure black on sides of head, chin, or throat. Cervical collar indicated, but dull and obscured. Black of crown overlaid with gray; superciliary and postocular stripe buffy; sides of head blackish, overlaid with gray; throat similarly varied, but chin nearly white; on the whole, the pattern

FIG. 224. — Lapland Longspur, in summer, reduced. (Sheppard del. Nichols sc.)

of the ♂'s black hood clearly indicated, but interrupted and ill-defined. Sides of breast and belly with few small sharp dark streaks, instead of heavy black stripes; other under parts as in the ♂. Bill obscure yellowish, dusky-tipped; feet dark brown, not black. Rather smaller. ♂ ♀, young, in winter, as usually seen in U. S., without any continuous black, resemble the adult ♀ as to coloration of head and fore parts, and are like winter ♂ in other respects. The cervical collar may be scarcely appreciable, but usually shows a trace at least; sides often quite brown. Fledglings: Continuously streaked on the upper and fore parts with blackish and brownish-yellow; wings and tail broadly edged with chestnut; bill dark; feet pale. A species of circumpolar distribution, like the last; breeding range and winter rovings much the same, but less commonly observed in the U. S. South irregularly to the Middle States, Ohio, Colorado, etc. Nesting like *P. nivalis;* eggs 4–6, 0.80 × 0.62, dark-colored, very heavily mottled and clouded with chocolate-brown, through which the greenish-gray ground scarcely appears.

221. **C. pic'tus.** (Lat. *pictus*, painted.) PAINTED LONGSPUR. Adult ♂: Cervical collar and entire under parts rich fawn color; crown and sides of head black, bounded below by a white line, and interrupted by a white superciliary and auricular line and white occipital spot. Upper parts streaked with black and brownish-yellow. Lesser and middle wing-coverts black, tipped with white, forming conspicuous patches. One or two outer tail-feathers mostly white. No white on the rest. Legs pale or flesh-colored. Size of *lapponicus*. Length 6.50; extent 11.25; wing 3.75; tail 2.50; tarsus 0.75; middle toe and claw, about the same; hind toe and claw, rather less (*C. ornatus* is much less in all its dimensions). Young, and generally in winter: Bill dusky-brown above and at tip, paler below; feet light brown (drying darker); toes rather darker. Entire under parts rich yellowish-brown, or buffy (in *C. ornatus* never thus); paler on the chin and throat, which, with the fore-breast, are obsoletely streaked with dusky; the tibiæ white. Tail white only on the two or three outer feathers (in *C. ornatus* all the feathers, excepting sometimes the central pair, are white at the base). Upper parts much as in the adult, but the distinctive head-markings wanting, or only obscurely indicated. Interior N. Am. from the region of the Yukon, McKenzie, Saskatchewan and upper Missouri to the prairies of Illinois in winter. It is not found in the Atlantic States, but is common on the prairies of Dakota, Montana, and southward, associated in the fall with *C. ornatus*, but breeding mostly farther north. Habits and general aspect of *ornatus*, but easily distinguished by larger size, buffy under parts, black and white wing-patch, and white only on some lateral instead of all of the tail-feathers. Nest on ground; eggs size of *lapponicus*, colored more like *ornatus*.

222. **C. orna'tus.** (Lat. *ornatus*, adorned). CHESTNUT-COLLARED LONGSPUR. BLACK-SHOULDERED LONGSPUR. WHITE-TAILED LONGSPUR. ♂, in full dress: Cervical collar intense chestnut. Crown black; a whitish spot on nape, and broad white superciliary stripe. Auriculars black, mixed with the color of the throat; throat and most of the sides of head below eyes rusty-white, changing to pure white which extends around sides of neck, partly bordering the chestnut collar. Breast and belly lustrous black, often mixed with intense ferruginous or mahogany feathers, sometimes largely overlaid with this rich sienna-color. Lining of wings pure white. Sides of body, flanks, lower belly and under tail-coverts, white, all but the last usually rusty-tinged. Back, rump, and scapulars brownish-black, varied with grayish-brown edges of the feathers. Wings dark brown without decided markings, though the feathers are pale-edged, excepting jet-black lesser coverts, with or without white tips. Tail like wings, but two or three lateral feathers entirely white, and all the rest basally white in decreasing amount: in flight, the "white tail" is very conspicuous. Bill blackish-plumbeous; feet dark. Smaller than the foregoing: Length 5.75–6.00, rarely 6.25; extent 10.25–10.75, rarely 11.00; wing 3.00–3.30; tail 2.00–2.30. ♀, in full dress: Rather smaller; size averaging about the lesser figures just given. Upper parts, wings, and tail as before, but lesser coverts not black; chestnut collar obscured; crown like back, separated from the back-markings by a slight rufous

dusky-streaked interval. Sides of head, and throat, whitish, with dusky speckling on cheeks and ears. Under parts dull brown, fading to white on belly and crissum, the feathers sometimes with dusky streaks. Thus an obscure bird: but observe generic characters, and extensively *white tail.* ♂, adult, after the fall moult: The full dress is confined to the breeding season; afterward, the colors are much obscured. Cervical collar and black of head and belly veiled by gray ends of the feathers, but visible on raising the plumage. Crown like back, with concealed black; superciliary stripe and other distinctive head-markings obliterated; bill brownish-plumbeous. The changes in the ♀ are parallel, but there is less to be altered. Young ♂ ♀, before first moult: Whole upper parts blackish-brown, with semicircular gray or whitish markings, and a slightly lighter cervical interval. Throat definitely white. Under parts dull brown, heavily streaked with dusky, especially on the breast. Much light brown edging and tipping of the quills and wing-coverts. Feet and bill pale. This stage is transitory; with the first moult the young acquire the characters above described for the winter. A beautiful species of the interior plains, British America and U. S. and Mexico; breeds in profusion on the prairies of Dakota, Montana, and whole upper Missouri and Saskatchewan regions, S. to Kansas or further; has occurred in New England; rarely W. of the Rocky Mts. Breeds in June and July; nest on ground, sunken flush with surface, of a few grasses and weed-stalks; eggs usually 4, about 0.80 × 0.60, white clouded with purplish shell-markings, gray the prevailing tone, this irregularly dotted and veined with sharp dark-brown surface-marks. Young covered with whitish down. In the breeding season the birds are fond of soaring and singing as they fly, rising to great height and letting themselves down with the wings held like parachutes; they curiously resemble butterflies when so engaged. The white tail shows very conspicuously. Ordinary flight wayward and vacillating; song weak and twittering, but pleasing. The birds flock as soon as young are fairly on wing, and leave the northern prairies in October. They are associated in the breeding season with *R. maccowni*, and joined in October by *P. pictus* and *lapponicus* from the north.

74. RHYNCHO'PHANES. (Gr. *ῥύγχος*, *rhugchos*, beak, and *φαίνω*, *phaino*, I appear; in allusion to the turgid bill.) Longspurs. Similar to *Centrophanes*, but departing in the direction of *Montifringilla* (an exotic genus). Bill turgid, very stout and large in comparison; culmen rising high on forehead, its outline almost a little concave. Hind toe and claw less developed. Hind claw not longer than its digit, not notably straightened. Sexes dissimilar. No cervical collar. ♂ with black pectoral crescent and red bend of wing. Habits of *Centrophanes* strictly.

223. R. maccown'i. (To Capt. J. P. McCown, U. S. A. Fig. 225.) Black-breasted Longspur. Bay-winged Longspur. ♂, in full dress: Upper parts slate-gray, streaked with dusky and grayish or yellowish-brown, especially on the interscapulars. No cervical collar, but a chestnut patch on the wings, formed by the median coverts. Crown jet-black, bounded by a white superciliary line; sides of head whitish, but auriculars more or less slaty. Throat white, bounded by firm black maxillary stripes. Breast jet-black, in broad crescentic form, sharply defined against the white throat, shading behind into slaty-blackish, becoming more and more mixed with white on the belly and sides, till posteriorly the parts are

Fig. 225. — Black-breasted Longspur, reduced. (Sheppard del. Nichols sc.)

pure white; lining of wings white. All the tail-feathers, except the middle pair, and bases and tips of intermediate ones, white, ending squarely across both webs. Bill blackish-plumbeous, pale at base below; feet brownish-black. Length about 6.00; extent 11.00–11.50; wing 3.30–3.60; tail 2.25; bill 0.50; tarsus 0.67; middle toe and claw rather less. ♀, in breeding plumage: Upper parts, wings, and tail as in the ♂ — coverts with at least a trace of chestnut, and tail displaying the rectangular shape of the white area; crown like back instead of black; no black maxillary stripes, and breast-crescent slaty-gray; throat whitish; bill and feet yellowish-brown, more or less obscured. The seasonal changes of plumage, as well as the sexual differences, are parallel with those of *P. ornatus;* there is the same veiling of black parts by gray, etc. Though so different from *ornatus* in full dress, the bird is very similar in other conditions, age for age, and sex for sex: but larger; no trace of chestnut on nape; trace at least on wing-coverts; and peculiar pattern of tail-feathers shown as soon as they sprout and never lost. Very young birds have curved edgings of the feathers of the upper parts; the under parts quite purely white, with some dusky streaks, and a buff suffusion on the breast. Region of the upper Missouri and its tributaries; N. to the Saskatchewan; not known W. of the Rocky Mts.; S. to Texas and Mexico; E. to Kansas and probably Iowa and Missouri. Breeds in profusion on the prairies from Colorado northward, in parts of Dakota and in Montana associated with *P. ornatus;* winters from Colorado southward. Its habits and manners are the same as those of *P. ornatus.* It has the same soaring singing flight, and parachute-like descent, "sliding down on the scale of its own music;" nesting the same; eggs resembling the paler varieties of *P. ornatus;* 0.80 × 0.60.

75. PASSERCULUS. (Lat. *passerculus*, a little sparrow; diminutive of *passer*, a sparrow.) Savanna Sparrows. Ground Sparrows. Bill rather slenderly conical, culmen, commissure and gonys about straight (bill more turgid in *P. rostratus* and *guttatus*). Wings longer than tail, point formed by outer 4 primaries, of nearly equal lengths; inner secondaries enlarged and flowing, reaching nearly or quite to end of primaries in the closed wing. Tail short, nearly even or little emarginate, of narrow pointed feathers. Feet slender, pale-colored, usually reaching when outstretched nearly or quite to end of tail; tarsus and middle toe with claw of about equal lengths; lateral toes of equal lengths, their claws underreaching base of middle claw; hind toe rather longer than its claw, which has no special development. Plumage thickly streaked everywhere above, and below on breast and sides; crown with median light line and lateral dark ones; no decided markings on tail-feathers. In most species edge of wing yellow, and traces at least of yellow on head; no red, blue, or greenish. Sexes alike. Embracing small plain streaked ground sparrows of slender build, mostly with a touch of lemon-yellow on edge of wing, long inner secondaries and pale slender legs; one species abounding in the East, others of more special distribution.

Analysis of Species and Varieties.

Bill typical. Crown with median light stripe. Inner secondaries seldom quite equalling primaries. No decided lemon-yellow on edge of wing. Top of head with two black stripes, and suffused with rich brownish-yellow . . . . . *bairdi* 224

Bill typical. Crown with median light stripe. Inner secondaries at full length. Edge of wing with lemon-yellow; same shade on head, if any. Upper parts much variegated; under white, with sharp streaking.

- Large, pale; little or no yellowish; length 6.00 or more; wing 3.25. Coast of New England *princeps* 225
- Large, dark, with decided yellow; length about 6.00; wing 3.00. Northwest coast . . *sandvicensis* 226
- Medium, of average coloration; length about 5.50; wing 2.75. N. Am. at large . . . . . *savana* 227
- Medium; pale; size of *savana* proper. Interior and western . . . . . *alaudinus* 229
- Small, dark; yellow very decided. Length about 5.25; wing 2.50. West coast . . . . . *anthinus* 228

Bill enlarged, turgid, with convex culmen. Crown-stripe obsolete. No yellow on head or wing.

- Larger: bill 0.50. Length 5.30; wing near 3.00. Pale brownish-gray, with obsolete streaking; the streaks below light brown. Coast of California . . . . . *rostratus* 230
- Smaller: bill 0.33. Length 5.00; wing 2.50. Darker, the streaks below dusky. L. Cala. . *guttatus* 231

224. P. baird'i. (To Prof. S. F. Baird. Fig. 226.) Baird's Savanna Sparrow. ♂ ♀, *adult, in breeding plumage:* With a general resemblance to ***P. savana.*** Inner secondaries less elon-

gated, rarely equalling the primaries in the closed wings. First 4 quills about equal and longest. Hind toe and claw about equalling the middle toe and claw, its claw about equalling the digit. Tail shorter than wing, lightly double-rounded (central and outer pair of feathers both a little shorter than the intermediate ones). Top of head streaked with black and rich brownish-yellow, or buff, the former predominating laterally, the latter chiefly as a median stripe, but also suffusing the nape and sides of head in greater or less degree. Back varied with brownish-black and gray, together with a little bay, the two latter colors forming the edgings of the interscapulars and scapulars. Rump variegated with gray and chestnut-brown, different in shade from that of the back. Under parts dull white, usually with a faint ochrey tinge on the breast, but often without; a circlet of small, sharp, sparse, dusky streaks across the breast, continuous with others, longer and mostly lighter, along the whole sides, and with others, again, extending up the sides of the neck into small vague maxillary and auricular markings. When the feathers are perfectly arranged these lateral head-markings are seen to be a post-ocular stripe just over the auriculars, a post-auricular spot, a streak starting from the angle of the mouth, and another heavier one parallel with and below this, running directly into the pectoral ones. Quills without special markings, excepting the elongated inner secondaries, which correspond with the scapulars. Tail the same, slightly whitish-edged. Upper mandible mostly dark, lower pale. Feet flesh-colored. Length 5.10–5.85, averaging 5.67; extent 8.60–9.85, average 9.50; wing 2.75–3.00; tail 2.00–2.25; culmen about 0.40; tarsus about 0.75; middle toe and claw, and hind toe and claw, each, rather less; ♀ averages rather smaller. *Autumnal plumage:* Soft, with brighter, more suffused colors, in bolder pattern. Whole top and sides of head, as well as nape and part of neck, suffused with rich buff, in many instances as bright a golden-brown as that on the head of *Siurus auricapillus*. A paler, rather ochraceous shade of the same also suffusing the whole fore under-parts. Pectoral and lateral dusky streaks, as well as the two rows on each side of the throat, large, heavy, diffuse. Bay and whitish edgings of the secondaries broad and conspicuous, contrasting with the black central fields. Whitish edgings of tail-feathers the same; and, in general, the same character is stamped over all the upper plumage. *Newly-fledged young* have each feather of the dorsal plumage conspicuously bordered with white, producing a set of semicircles, much as in *Neocorys spraguii*. There is the same general buffy suffusion of the head and fore parts as in autumnal adults, but the tint is dull and ochrey. The markings below have a short, broad, guttiform character. When just from the nest, the edging of the secondaries and tail-feathers is of a peculiar pinkish-rusty shade. Central Plains, U. S.; N. to British Provinces; E. nearly to Red River of the North; S. to Texas, N. Mex. and Arizona; W. to the Rocky Mts., and beyond. An interesting sparrow, long almost unknown till I found it breeding in profusion in Dakota, taking 75 specimens one season. In general habits and appearance in life quite like savanna sparrows; mixing freely with these and *Neocorys*, *Eremophila*, and *Plectrophanes ornatus*. Song peculiar, of two or three tinkling syllables and a trill, like *zip-zip-zip-zr-r-r-r*. Nest on ground, a slight structure of grasses and weed-stalks, about 4 inches across; eggs 5, 0.80 × 0.65, white, irregularly speckled and blotched with pale and dark reddish-browns, laid in June and July.

FIG. 226. — Baird's Savanna Sparrow, reduced. (Sheppard del. Nichols sc.)

225. P. prin'ceps. (Lat. *princeps*, chief.) IPSWICH SAVANNA SPARROW. ♂: General appearance of a large savanna sparrow, but with a resemblance to a bay-winged bunting. Upper

parts grayish-brown, with blackish rufous-edged centres of the feathers; median crown-stripe not strong, and scarcely yellowish; a whitish superciliary stripe, not yellow anteriorly; ear-coverts grayish, with a rufous tinge. Scapulars, coverts and secondaries blackish-brown, broadly edged with rufous, brightest on the secondaries; scapulars also edged with white, and both median and greater coverts white-tipped. Tail brownish, tipped and edged with whitish. Whole under parts white, breast and sides of throat and body streaked, the streaks dusky-centred, rufous-edged. Bill dark brown, base of under mandible paler; eyes and feet brown. Length 6.30; extent 11.00; wing 3.25; tail 2.60; bill 0.45; tarsus 0.95; middle toe and claw 1.05; hind toe and claw 0.72. (Foregoing condensed from original description of the type, taken in winter. Following as redescribed by Ridgway.) Bill of size and shape as in *P. bairdi* exactly; inner secondaries little lengthened. Outstretched feet not reaching to end of tail. In color almost exactly as in *P. rostratus*, but different in markings; above light ashy, the dorsal feathers light sandy-brown centrally, their shafts black. Surface of wings pale sandy-brown, the feathers darker-centred; inner secondaries with whitish outer webs, and conspicuous black central field. Crown becoming darker brown anteriorly, where an indistinct median line of ochrey-white; an indistinct superciliary stripe, and conspicuous maxillary stripe of the same, the latter bordered above by a narrow dusky stripe; lores and cheeks like the superciliary stripe; auriculars like crown. Below, white, slightly ashy on flanks; whole breast and sides of body with narrow streaks of blackish-centred sandy-brown; belly, crissum, and lining of wings immaculate; throat with a few minute specks, but on each side a bridle of suffuse streaks. ♀: wing 2.90; tail 2.40; culmen 0.50; tarsus 0.85. (Following notes taken by me of a specimen received from Maynard; ♀, Ipswich, Oct. 18, 1872: No. 73,553, Mus. S. I.) "About size of largest *P. sandvicensis* from Alaska. No trace of yellow on head or wing. Upper parts even paler and grayer than extreme of *P. alaudinus* from the West — the streaks of upper parts having only shaft-lines of blackish-brown, brown-edged, the edges of the feathers finally gray; nape, rump, and upper tail-coverts gray, scarcely streaked at all. Crown streaked like interscapulars, but in smaller pattern; divided by a median light line. A long whitish (not yellowish) superciliary line; lore gray below this. Inner secondaries and greater coverts blackish, broadly edged on outer webs with bay, fading to whitish at tips; median coverts similar, but more noticeably whitish-tipped; these edgings of wing-feathers making the strongest coloration of all the upper parts. Below, white; throat and middle of belly only immaculate, flanks a little shaded with gray; whole breast, sides of neck and body, and crissum, with brown streaks, pale in comparison with those of *P. savana*, and rather suffuse. On the sides of head below auriculars the stripes tend to form two chains — a maxillary one and another above it separated by an immaculate interval. Resembles *P. rostratus* in diffuse grayish coloration and lack of yellow on head or wing. Looks as a hybrid between *P. savana* and *Poœcetes* might be supposed to do." Seems distinct, but not firmly established as a species. Coast of New England, especially sand-hills of the Massachusetts coast; general range unknown; perhaps a local race. Curiously similar in some respects to the Californian litoral form *P. rostratus*.

226. P. sandvicen'sis. (Of the Sandwich, one of the Aleutian Islands.) Similar to the ordinary savanna sparrow: averaging in size about the maximum of the latter: length about 6.00; wing 3.00; tail 2.25; culmen 0.45; depth of bill at base 0.25; tarsus, and middle toe and claw, each, 0.80. Bill nearly twice as bulky as that of ordinary *savana*. A firm bright yellow superciliary stripe from nostril to eye, thence fading over auriculars (i. e., *chrysops*, Pall.) Under parts precisely as in *savana;* upper similar, but grayer — less rufous and more gray in the edgings of the feathers. Such are the peculiarities of a specimen from the very spot whence Latham and Pennant describe their bird; they are appreciable on laying the skin alongside a large varying series of Eastern *savana*. Alaska. But it does not follow that all the Alaskan and Aleutian savanna sparrows are like this.

227. P. s. sava'na. (Spanish *sabana* or *savana*, a meadow. Fig. 227.) Common Savanna Sparrow. ♂ ♀, adult, in spring: Thickly streaked everywhere above, on sides, and across breast; a superciliary line, and edge of the wing, *yellowish;* lesser wing-coverts *not* chestnut; legs flesh-color; bill rather slender and acute; tail nearly even, its outer feathers not white; longest secondary nearly as long as the primaries in the closed wing. Above, brownish-gray, streaked with blackish, whitish-gray and pale bay, the streaks largest on interscapulars, smallest on cervix, the crown divided by an obscure whitish line; sometimes an obscure yellowish suffusion about head besides the streak over the eye. Below, white, pure or with faint buffy shade, thickly streaked, as just stated, with dusky — the individual spots edged with brown, mostly arrow-shaped, running in chains along the sides, and often aggregated in an obscure blotch on the breast. Wings dusky, the coverts and inner secondaries black-edged and tipped with bright bay; tail-feathers rather narrow and pointed, dusky, not noticeably marked. Extreme dimensions of both sexes: Length 5.20–6.00; extent 8.50–10.00! wing 2.40–3.00; tail 1.75–2.25; tarsus 0.75–0.88; but such figures are rare. Average of both sexes 5.25; extent 8.75; wing 2.60; tail 2.00; tarsus 0.84. ♂ usually 5.30–5.60; extent 9.00–9.50; wing 2.67–2.75; ♀ usually 5.00–5.30; extent 8.75–9.00; wing 2.50–2.67. Ordinarily, bill about 0.40; tarsus, middle toe and claw together 1.50. Fall and winter specimens much more brightly colored than spring and summer ones; the young particularly having much ochrey or buffy suffusion, instead of clean colors, more brown and bay, instead of dusky and gray. It is not easy for an unpractised person to discriminate the small sparrows, and so variable a one as this offers special difficulty; attention to the points of *form* as well as of color is requisite. North Amer. at large, chiefly Eastern, very abundant everywhere in fields, on plains, by the wayside, and along the sea-shore; a thoroughly terrestrial bird, migratory, and in the fall somewhat gregarious. Has an agreeable though weak song in the spring. Winters at least from Middle States southward, and breeds at least from New England to highest latitudes. Nest sunken in ground flush with surface, of a few grasses and weed-stalks; eggs 4–6, 0.70 × 0.50, varying interminably in their motley coloring; usually heavily clouded and blotched with dark brown; most like those of *Poœcetes*, but smaller.

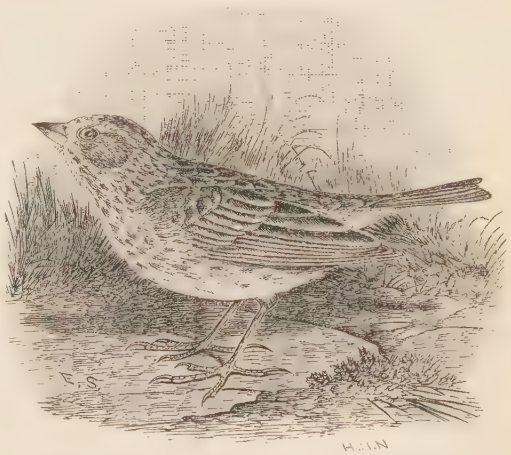

Fig. 227.—Common Savanna Sparrow, reduced. (Sheppard del. Nichols sc.)

229. P. s. alaudi'nus. (Lat. *alaudinus*, lark-like; no applicability.) Lark Savanna Sparrow. So similar to the last as only to be distinguished by rather duller and paler coloration on an average, and weaker bill, about 0.35 long by 0.20 deep at the base. If the "savanna sparrow" be split into several races, this may possibly be allowed with the rest. Western U. S.

228. P. s. anthi'nus. (Lat. *anthinus*, pipit-like; no applicability.) Pipit Savanna Sparrow. A form from the Pacific marshes, especially the coast of Cala., better marked than the last. Bill as long as in *savana*, but slenderer; under parts more sharply, closely, darkly and extensively streaked. Yellow eyebrow and bend of wing quite as well marked as in *savana*, and therefore contrasting with the paler and grayer *alaudinus* with which it is associated.

230. P. rostra'tus. (Lat. *rostratus*, beaked; *rostrum*, beak.) Beaked Savanna Sparrow. San Diego Savanna Sparrow. Sea-shore Sparrow. With the form of a Savanna, but the bill elongated as in *Ammodramus*, yet very stout and turgid, with decidedly convex

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culmen 0.50 long. No yellowish over eye or on edge of wing; no evident median stripe on crown. Brownish-gray, obsoletely streaked with dark brown, most noticeable on crown and middle of back; entire under parts dull white, confluently streaked with clear brown everywhere except on throat, middle of belly, and crissum. Wings and tail dusky-gray, the rectrices with paler edges, the primaries with whitish edges, the wing-coverts and secondaries broadly edged and tipped with grayish-bay. An obscure whitish superciliary line. Bill light brown, under mandible paler or yellowish; legs pale. Length 5.25; wing 2.50–2.75; tail 2.00. Pacific coast, U. S., especially California; a curious species, common, maritime, representing, with var. *anthinus*, the *Ammodrami* in the marshes of the seashore.

231. P. gutta'tus. (Lat. *guttatus*, spotted; *gutta*, a drop.) St. Lucas Savanna Sparrow. Bill shaped as in *rostratus*, relatively as stout, but smaller; culmen 0.45; depth at base 0.25. Bird smaller: pattern of coloration the same, but tone darker; streaking of the under parts sharper, heavier, and darker. Instead of the light brownish-gray of *rostratus* the upper parts are here dark, almost olivaceous, brown, so that the dark streaking of the crown and interscapulars is less noticeable. The same difference characterizes the under parts. Cape St. Lucas.

Obs. There is a sparrow of the L. Cala. Gulf coast and islands like *guttatus:* larger; wing 2.75; bill 0.50, at base 0.30 deep, thus as large as that of *rostratus*, but regularly conic, with straight culmen suddenly deflected at end, and perfectly straight commissure; upper mandible and tip of lower blackish; rest apparently yellowish. *An n. sp.?* **P. sanctorum** *N.*, Mus. S. I., San Benito Isl. (See Pr. U. S. Nat. Mus., March, 1883, p. 538.)

76. POŒ'CETES. (Gr. *πόη, poe*, grass; *οἰκέτης, oiketes*, an inhabitant.) Grass Sparrows. Bill moderate, culmen, gonys and commissure nearly straight. Wings long, longer than tail, tip formed by first 4 quills; inner secondaries somewhat elongate, less so than in *Passerculus*. Tail emarginate, with rather broad firm feathers, not acuminate at ends. Tarsus about as long as middle toe without claw; lateral toes of about equal lengths, their claws scarcely reaching base of middle claw; hind claw as usual, not longer than its digit. Plumage thickly streaked everywhere above, on sides below and across breast; bend of wing chestnut; 1–3 outer tail feathers white; crown without light median stripe; no trace of yellow anywhere.

232. P. grami'neus. (Lat. *gramineus*, applied to a grass-loving bird; *gramen*, grass. Fig. 228.) Grass Finch. Bay-winged Bunting. Vesper-bird. Above, grayish-brown, closely and uniformly marked with dusky-centred brown-edged streaks, and further variegated by pale gray edging of the feathers. Crown quite like back, though the marking is in smaller pattern; superciliary line and eye-ring whitish. Under parts dull white, usually noticeably buff-tinged in the streaked areas, thickly streaked across breast and along sides with dusky-centred brown-edged streaks, anteriorly tending to concentrate in lateral chains bounding the white throat; above this chain a maxillary brown stripe; auriculars varied with light and dark brown. Quills fuscous, the longer ones with grayish-white edging, the secondaries and greater and median coverts with broad firm brown and white edges and tips; lesser coverts bright chestnut, whence the name "bay-winged." Outer tail-feather largely or wholly white, next pair or two pairs largely white in decreasing amount. Upper mandible brown; lower, and the feet, flesh-

Fig. 228. — Bay-winged Bunting, reduced. (Sheppard del. Nichols sc.)

colored or yellowish. Length 5.75–6.25; extent 10.00–10.50; wing 2.80–3.25; tail 2.25–2.75. North Amer. at large, breeding throughout its range, but partially migratory, chiefly nesting northward, and wintering southward. A large, stout, full-chested sparrow of plain appearance, but recognized on sight by the bay bend of the wing and white lateral tail feathers, — the latter conspicuous as it flies. Very abundant in fields, along roadsides; terrestrial, gregarious to some extent when not breeding. Nest sunken in the ground, bulky, thick-rimmed, deeply cupped; eggs 4–6, heavily colored, as in *P. savana*, 0.80 × 0.60; two or three broods may be reared. One of the sweetest songsters among the sparrows.

233. **P. g. confi'nis.** (Lat. *confinis*, near.) WESTERN GRASS FINCH. The paler, grayer form from the dry western regions.

77. **COTURNI'CULUS.** (Lat. *coturnix*, a quail; *coturniculus*, a little quail.) GRASSHOPPER SPARROWS. Bill (in *passerinus* and *henslowi*) short and stout, with curved culmen (in *lecontii* slenderer and more elongate). Wings extremely short and rounded, so that the inner secondaries reach nearly to the tip when closed, without special elongation on their part. Tail of variable length according to species, weak, of narrow, lanceolate feathers, in one species very tapering and acuminate. Feet stout, much as in *Ammodramus*. Plumage greatly variegated; buffy tints conspicuous on under parts. Contains 3 remarkably distinct N. Am. species of queer little sparrows of grass, weeds, and reeds, with another of S. Am. (*C. manimbe*). They show a greater range of variation in form than our finical modern genera usually allow, and shade through *C. lecontii* into *Ammodramus*. The name is appropriate; *C. passerinus* curiously resembles a quail in miniature.

Analysis of Species.

Tail shorter than wings; outstretched feet reaching to or beyond its end. Bill stout, brown. Adult not evidently streaked below . . . . . *passerinus* 234, 235
Tail equal to wings. Sharp maxillary, pectoral and lateral streaks. Bill stout, brown . . . *henslowi* 236
Tail longer than wings; outstretched feet not reaching its end. Bill slender, bluish. Sharp lateral without pectoral or maxillary streaks . . . . . *lecontii* 237

234. **C. passeri'nus.** (Lat. *passerinus*, sparrow-like. Fig. 229.) YELLOW-WINGED SPARROW. QUAIL SPARROW. GRASSHOPPER SPARROW. ♂ ♀, adult: Edge of wing conspicuously yellow; lesser wing-coverts greenish-yellow; a yellow loral spot; short line over eye buffy-yellow. Crown with median stripe of pale brownish-yellow. Below, ochraceous or pale buff or tawny, fading to whitish on belly, not evidently streaked, though a few dark touches may appear on sides of breast. Above, singularly variegated with black, gray, yellowish-brown and a peculiar purplish-bay, in short streaks and specks; the crown being nearly black with sharp median brownish-yellow stripe, the middle of the back chiefly black with bay and brownish-yellow edgings of the feathers, the cervical region and rump chiefly bay and gray. When the feathers are not disturbed, the peculiar pattern of the cervical region separates that of the crown and back; the markings extend on the sides of the neck, but the sides of the head are plain, like the under parts. Wing-coverts and inner secondaries variegated in intricate pattern, the general effect like the back. Primaries and tail-feathers plain dusky, with narrow light edgings; outer tail-feathers paler, but not white. Feet flesh-colored. Small: length 4.80–5.25;

FIG. 229. — Yellow-winged Sparrow, reduced. (Sheppard del. Nichols sc.)

extent 8.00–8.50; wing 2 25–2.50; tail 2.00 or less, shorter than wing, outstretched feet reaching beyond it; rounded or rather double-rounded at end, the feathers narrow and lanceolate. Bill very stout and full. In autumn, fresh-moulted birds are as usual richer in color, the markings more blended and diffuse, the fore parts below and the sides rich buffy brown, in which vague lighter and darker markings usually appear. Young: before the moult, are whitish below, with decided dusky maxillary and pectoral streaks, thus resembling *C. henslowi*. Eastern U. S. and Canada, but not far north; breeds throughout its range; resident in the Southern States, elsewhere a migrant and summer visitant. Abundant in the rank herbage of old fields, but less frequently observed than it would be did it not hide so persistently in the herbage; has a peculiar chirring note, like a grasshopper's; nests on the ground; eggs 4–5, crystal white, flecked with reddish-brown, 0.72 × 0.64.

235. C. p. perpal'lidus. (Lat. *perpallidus*, very pale.) Bleached Yellow-winged Sparrow. Specimens from dry western regions are paler and grayer; less black and more slaty-gray on the upper parts, the ochrey crown stripe and edgings of the dorsal feathers, as well as the under parts generally, paler.

236. C. hen'slowi. (To Prof. J. S. Henslow, of England.) Henslow's Grasshopper Sparrow. Somewhat resembling a *young C. passerinus*. Under parts whitish, tinged strongly along the whole sides, across the breast, and on the flanks and crissum with buff, all these buff parts sharply and distinctly streaked with blackish in fine pattern; the pectoral streaks connecting along the sides of neck with decided black maxillary stripes. The brownish-yellow shade is very variable in extent and intensity, but it usually leaves only the throat and belly decidedly whitish. Ground-color of head and hind neck a peculiar pale olive-gray, with a decided greenish-yellow tinge; top of head with broad lateral blackish stripes, continued on the cervix in much smaller pattern, divided by a greenish-brownish-yellow median stripe. The peculiar color of the hind neck extending far around on sides of neck, and sides of head of much the same tint; a blackish post-ocular stripe bounding the auriculars above; below and anterior to them a black maxillary stripe starting from the angle of the mouth; below this usually other maxillary streaks; dark specks often behind auriculars. Dorsal and scapular feathers with broad black central field, then broadly chestnut, then mostly narrowly edged with whitish, these markings in bold pattern, and contrasting with the peculiar greenish-gray cervical region with its fine black streaks. Edge of wing yellow. Greater wing-coverts and most of the secondaries colored to correspond with the back, the closed wing showing chiefly chestnut with the black field of the three innermost secondaries. Tail-feathers extremely narrow and acute, brown, the inner at least with long blackish shaft stripe, and reddish-brown on inner webs. Bill brownish, usually quite dusky above, pale below; feet pale. Length scarcely 5.00; extent 7.50; wing and tail, each, 2.00–2.10; bill from extreme base of culmen 0.45; 0.30 deep at base; tarsus or middle toe and claw 0.65. Eastern U. S., strictly, N. to New England, not very commonly; W. to Nebraska. Not abundant on the whole, nor easily observed. Common about Washington, where it breeds, in fields and meadows; nest on the ground, in tufts of grass. Eggs 4–5, greenish-white, profusely speckled with reddish, 0.75 × 0.57.

237. C. lecon'tii. (To Maj. J. Le Conte, of Philadelphia.) Le Conte's Grasshopper Sparrow. Le Conte's Bunting. ♂ ♀, adult: Bill smaller and slenderer than in either of the foregoing, dark horn-blue above, paler bluish below; iris black. Tail long, decidedly exceeding the wings when full grown, and remarkably graduated; lateral feathers ½–½ inch shorter than the central pair; all extremely narrow, tapering, and acuminate, even more so than in the sharp-tailed finch (*Ammodramus caudacutus*); outstretched feet not reaching to its end. Wings short and much rounded; primaries in closed wing hardly ¼ inch longer than secondaries. Length 4.90–5.10; extent 6.90–7.10; wing 1.90–2.00; tail 2.00–2.25 or a little more; bill 0.40; tarsus 0.67. No trace of yellow on bend of wing, nor any yellow loral spot. No black maxillary or pectoral streaks; markings of under parts confined to sparse, sharp, blackish

streaks on the sides. General coloration more or less buff, according to age and season. Crown with black lateral stripes, separated by a whitish stripe becoming ochrey on forehead. Sides of head buff, brightest on the long broad superciliary line, enclosing slaty-gray auriculars, which are bordered above by a black post-ocular line, sometimes chiefly appearing as a dark speck behind them. Cervical feathers bay, black-shafted and whitish-edged, forming a distinct interval between markings of back and crown. Dorsal feathers in bold pattern, with black terminal central field, little rufous and much whitish or buffy edging; streaking extending on rump and upper tail-coverts. Wing-coverts and inner secondaries colored boldly to correspond with the back. Under parts buffy-white, sometimes quite whitish, again much more buffy, with season, usually quite buff with only belly whitish. Fresh moulted fall birds are often entirely deep buff below, excepting the belly, which is white, in marked contrast. Young: Bill still smaller, reddish-brown instead of bluish; general color buff above, whitish below, more or less buffy on breast and sides; markings of upper parts black, without the bay and brown variegation, except on wings and tail, which are nearly as in the adults; sparse black streaks of under parts usually appearing across breast as well as on sides. An interesting, long-lost species, recently rediscovered: Yellowstone R. (*Audubon*, 1843); Texas (*Lincecum*); Dakota (*Coues*, 1873); Illinois (*Nelson*, 1875); Iowa (*Newton*, 1875); Minnesota (*Tiffany*, 1878); South Carolina! (*Loomis*, 1881.) Approaching *Ammodramus caudacutus* in many respects, and inhabiting similar resorts in the interior. Nest and eggs still unknown.

78. **AMMO'DRAMUS.** (Gr. ἄμμος, *ammos*, sand; δραμεῖν, *dramein*, to run.) SEA-SIDE SPARROWS. Bill remarkably slender and lengthened for this family, with culmen decurved toward end, gonys straight, and sometimes an evident lobation of the cutting edge of the upper mandible. Wings short and rounded, yet longer than tail; inner secondaries, though not elongate, reaching nearly to end of primaries when wing is closed; point formed by 2d–4th quills. Feet large and stout, reaching outstretched about to end of tail; tarsus about equal to middle toe and claw in length; lateral toes of equal lengths, very short, their claws underreaching base of middle claw. Tail shorter or not longer than wings, much rounded, of narrow, stiffish, sharp-pointed feathers. Embracing small streaky marsh sparrows, especially of the sea-coast, but not exclusively maritime, as long supposed; remarkable for slenderness of the bill, sharp narrow tail-feathers, and stout feet fitted for grasping slender swaying reeds. Edge of wing bright yellow; a yellow spot or buff stripe on head; upper parts olive-gray or quite blackish, streaky.

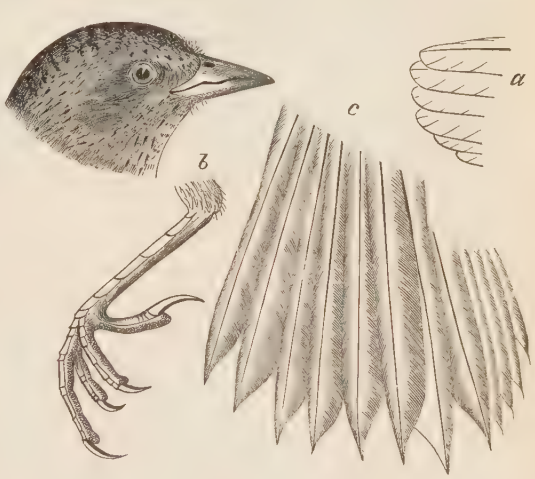


FIG 230 — Generic details of *Ammodramus* (*A. caudacutus*), nat. size. (Ad. nat. del. E. C.)

Analysis of Species.

Loral spot and edge of wing bright yellow.
- Upper parts olive-gray obscurely streaked . . . . . *maritimus* 238
- Upper parts quite blackish . . . . . *nigrescens* 239

A long buff superciliary stripe . . . . . *caudacutus* 240–241

238. **A. mari'timus.** (Lat. *maritimus*, maritime, coast-wise; *mare*, the sea. Fig. 230.) SEA-SIDE FINCH. Olive-gray, obscurely streaked on back and crown with darker and paler; below, whitish, often washed with brownish, shaded on sides with color of back, and with ill-defined dark

streaks on breast and sides; maxillary stripes of the same; wings and tail plain dusky, with slight olivaceous edgings; wing-coverts and inner quills somewhat margined with brown; edge of wing bright yellow; a bright *yellow spot* on lore, and often some vague brownish and dusky markings on side of head; bill plumbeous, or dark horn-blue; feet dark. Length 5.75–6.25; extent 8.50; wing 2.25–2.50; tail about 2.00. Recognizable on sight by the bright yellow edge of wing and loral spot, with little varied olive-gray upper parts. Salt marshes of the Atlantic and Gulf coast; abundant. North to Massachusetts; breeds throughout its range, and resident in the south, but screened from casual observation by the nature of its haunts and habits. Nest in a tussock of grass just out of water; eggs 0.75 × 0.55, grayish-white, thickly and pretty evenly marked.

239. A. m. nigres'cens. (Lat. *nigrescens*, growing black.) FLORIDA SEA-SIDE FINCH. Like *A. maritimus;* rather smaller bodied, though members not shorter, and conspicuously different in color, being almost entirely black and white. Upper parts sooty-black, slightly variegated with slate-colored edgings of the feathers, and some pale gray edgings of the interscapulars. Below white, heavily streaked with blackish everywhere excepting on the throat and middle of belly. A bright yellow loral spot, and bend of the wing bright yellow (both very conspicuous in the black plumage). Wing-quills blackish, the inner secondaries quite black; all narrowly edged with brownish. Tail black, with gray edgings of the feathers, — these edgings tending to form scallops with the black central field. Bill and feet as in *A. maritimus.* A curious local race, resident in Florida.

FIG. 231. — Sea-side Finch, reduced. (Sheppard del. Nichols sc.)

240. A. caudacu'tus. (Lat. *cauda*, tail; *acutus*, sharp. Fig. 231.) SHARP-TAILED FINCH. Olive-gray, sharply streaked on the back with blackish and whitish, less so on the rump with blackish alone. Crown darker than nape, with brownish-black streaks, tending to form lateral stripes and obscure olive-gray median line; no yellow loral spot, but long line over eye and sides of head rich buff or orange-brown, enclosing olive-gray auriculars and a dark speck behind them, or dark post-ocular stripe over them. Olive-gray of cervix extending around on sides of neck. Below, white; the fore parts and sides tinged with yellowish-brown or buff of variable intensity, the breast and sides sharply streaked with dusky. Greater coverts and inner secondaries with blackish field toward their ends, broadly margined with rusty brown and whitish. Tail-feathers brown, with dusky shaft-stripes and tendency to "water" with crosswise wavy bars. Bill blackish above, pale or not below, feet brown. Coloration in spring and summer clearer and paler, in fall and in young birds more brightly and extensively buff. Rather smaller than *A. maritimus;* bill still slenderer, and tail-feathers still narrower and more acute. Length 5.10–5.50; extent 7.50; wing 2.25; tail 2.00; bill 0.45–0.50; tarsus, or middle toe and claw, 0.75. Salt marshes of the Atlantic and Gulf States, N. abundantly to Maine; range similar to that of *A. maritimus,* but on the whole more northerly, especially in the breeding season; nest and eggs similar and scarcely distinguishable.

241. A. c. nel'soni. (To E. W. Nelson, of Illinois.) Similar to the last, but smaller, with bill slenderer and longer; colors brighter and markings more sharply defined. Fresh marshes of Illinois and other portions of the Mississippi Valley at large; N. probably to Canada.

79. **MELOSPI'ZA.** (Gr. μέλος, *melos*, song, melody, and σπίζα, *spiza*, name of some Finch in Aristotle). Song Sparrows. Bill moderate, conic, without special turgidity or compression, outlines of culmen, commissure, gonys and sides nearly or about straight. Wings short and much rounded, folding little beyond base of tail; 1st primary quite short; point of wing formed by 3d, 4th, and 5th, supported closely by 2d and 6th; inner secondaries not elongated. Tail long, about equalling or rather exceeding the wings, much rounded, with firm feathers broad to their rounded ends. Feet moderately stout; tarsus scarcely or not longer than middle toe and claw; lateral toes slightly unequal, outer the longer, its claw scarcely or not reaching base of middle claw. Embracing a large number of middle-sized and large sparrows, without a trace of yellow anywhere, and of brownish-yellow only in *M. lincolni;* upper parts, including crown, thickly streaked; under parts white or ashy, thickly streaked across breast and along sides (excepting adult *M. palustris*). No bright color anywhere, and no colors in masses. The type of the genus is the familiar and beloved song sparrow, — a bird of constant characters in the East, but which in the West is split into numerous geographical races, some of them looking so different from typical *fasciata* that they have been considered as distinct species, and even placed in other genera. This differentiation affects not only the color, but the size, relative proportion of parts, and particularly the shape of the bill; and it is sometimes so great, as in case of *M. cinerea*, that less dissimilar-looking birds are commonly assigned to different genera. Nevertheless, the gradation is complete, and effected by imperceptible degrees. Some Northwestern forms of great size and dark colors are easily discriminated, but there are U. S. birds from Atlantic to Pacific which are not readily told apart. The student should not be discouraged if a subject which has tried the chiefs perplexes him; nor must he expect to find drawn on paper hard and fast lines which do not exist in nature. The curt antithetical expressions used in constructing the analysis of species and varieties necessarily exaggerate the case, and are only true as indicating the typical style of each; plenty of specimens lie "between the lines" as written. In going over a large series of Western song sparrows — specimens picked to illustrate types of style rather than connecting links, it still seems to me that distinctions have been somewhat forced; and that, also, different degrees of variation are thrown out of proper perspective by reducing all the forms to the same varietal plane. Thus, the differences between *cinerea* and all the rest, or between *rufina* and *fasciata*, are much greater than between *rufina* and *guttata* for instance, or between *fallax* and *fasciata*. In any outline of the genus the curves and angles indicated by Baird in 1858 are as far as they go nicer qualifications than the dead-level varieties later in vogue. The several degrees of likeness and unlikeness may be thrown into true relief better by some such expressions as the following than by formal antithetical phrases: — 1. The common eastern bird slightly modified in the arid interior into the duller colored 2. *fallax*. This, in the Pacific water shed, more decidedly modified by deeper coloration, — broader black streaks in 3. *heermanni*, with its diminutive local race 4. *samuelis*, and more ruddy shades in 5. *guttata* northward increasing in intensity, with increased size, in 6. *rufina*. Then the remarkable 7. *cinerea*, insulated much further apart than any of the others. A former American school would probably have made four "good species." 1. *fasciata;* 2. *samuelis;* 3. *rufina;* 4. *cinerea*. The present British school might perhaps

Fig. 232. — Lincoln's Song-Sparrow reduced. (Sheppard del. Nichols sc.)

handle them as 1. *fasciata* and *fallax*, with *a*, *heermanni;* 2. *samuelis;* 3. *rufina*, with *a*, *guttata*. 4. *cinerea*.

Analysis of Species and Varieties.

Breast streaked, and with a transverse belt of brownish-yellow: tail nearly equal to wings . . *lincolni* 242
Breast ashy, unbelted, with few streaks, or none; tail about equal to wings . . . . . *palustris* 243
Breast white, or brownish-white, with numerous streaks; tail usually longer than the wings, both rounded
Thickly streaked above, on sides, and across breast . . . . . *fasciata* and its varieties 244–250
The streaks distinct, decidedly blackish-centred (in breeding plumage).
Tone of upper parts grayish-brown or reddish-gray. Streaked from head to tail. Dorsal streaks black, rufous, and grayish-white. Wing 2.60; tail under 3.00. Eastern N. A. . . . . *fasciata* 244
Tone of upper parts gray. Streaks obsolete on rump. Dorsal streaks narrowly blackish and grayish-white, with little rufous. Tail about 3.00. Southern Rocky Mt. region . . . . . *fallax* 245
Tone of upper parts ashy-gray. Streaks obsolete on rump. Dorsal streaks broadly black, with little rufous and scarcely any grayish-white. Size of the first. California . . . . . *heermanni* 248
Tone of upper parts olive-gray. Streaks on rump and upper tail-coverts. Dorsal streaks as in the last. Very small. Wing 2.25; tail 2.50. Coast of California . . . . . *samuelis* 249
The streaks diffuse, not black-centred nor whitish-edged. Bill slender. Pacific, coastwise.
Tone of upper parts rufous-brown. Streaks above and below dark rufous. Medium-sized; wing 2.60; tail under 3.00. Pacific coast, U. S. and British Columbia . . . . . *guttata* 246
Tone of upper parts olive-brown. Streaks sooty. Larger; wing and tail about 3.00. Pacific coast, British Columbia and Alaska . . . . . *rufina* 247
Tone of upper parts dark cinereous. Streaking reddish-brown. Largest; wing and tail 3.25 or more *cinerea* 250

242. M. lin/colni. (To Robert Lincoln. Fig. 232.) Lincoln's Song Sparrow. ♂, ♀: Below, white, with a broad brownish-yellow belt across breast, the sides of the body and neck, and the crissum, washed with the same; extent and intensity of this buff very variable, often leaving only chin, throat, and belly purely white, but a pectoral band is always evident. All the buffy parts sharply and thickly streaked with dusky. Above, grayish-brown, with numerous sharp black-centred, brown-edged streaks. Top of head ashy, with a pair of dark brown black-streaked stripes; *or*, say, top of head brown, streaked with black, and with median and lateral ashy stripes. Below the superciliary ashy stripe is a narrow dark brown one, running from eye over ear; auriculars also bounded below by an indistinct dark brown stripe, below which and behind the auriculars the parts are suffused with buff. Wings with much rufous-brown edging of all the quills; inner secondaries and coverts having quite black central fields, with broad bay edging, becoming whitish toward their ends. Tail brown, the feathers with pale edges, and the central pair at least with dusky shaft-stripes. Bill blackish, lighter below; feet brownish. Length 5.50–6.00; extent 7.75–8.25; wing and tail, each, about 2.50, the latter rather shorter. There is little variation in color, except as above said. Fall specimens are usually most buffy. Very young: Before the fall moult, birds of the year are much browner above, with considerable brownish-yellow streaking besides the black markings; top of head quite like back, the ashy stripes not being established; whole under parts brownish-yellow, merely paler on throat and belly, dusky-streaked throughout. North Am. at large; a peculiar species, not so well known as it might be, less numerous in the Atlantic States than in the interior and west; and keeping very close in shrubbery. Migratory; winters in the South; breeds at least from N. Y. and N. England to Arctic regions, and in the West S. at least to Mts. of Colorado. Nesting like that of the song sparrow, and eggs not distinguishable with certainty.

243. M. palus/tris. (Lat. *palustris*, swampy; *palus*, a swamp. Fig. 233.) Swamp Song Sparrow. ♂ ♀, perfect plumage: Crown bright chestnut, blackening on forehead, the red cap and black vizor as conspicuous as in a chipping sparrow; but oftener, crown with obscure median ashy line, and streaked with black. An ashy-gray superciliary line; a dark brown postocular stripe, bordering the auriculars; sides of head ashy, with grayish-brown auriculars, dusky speckling on cheeks and lores, and slight dusky maxillary spots or streaks. An ashy cervical collar separating the chestnut crown from the back, sometimes pure, oftener interrupted with blackish streaks. The general ash of the sides of head and neck spreads all over the breast

and under parts, fading to whitish on throat and belly; the sides, flanks, and crissum marked with brown, and obsoletely streaked with darker brown. Back and rump brown, rather darker than sides of body, boldly variegated with black central streaks of the feathers and their pale brown or grayish edges. Wings so strongly edged with bright bay as to appear almost uniformly brownish-red when closed; but inner secondaries and greater coverts showing some black and whitish besides the bay. Tail likewise strongly edged with bay, and usually showing sharp black shaft lines. Thus well marked by the emphasis of black, bay, and ash. Length 5.40–5.80, usually 5.60; extent 7.50–8.00; wing and tail, each, 2.20–2.40. Varies little except as above noted, and in extent and intensity of the ash on fore and under parts. In birds of the first autumn, the crown may be quite blackish, with little chestnut and an ashy median stripe. Very young birds may be conspicuously streaked below, and a few streaks may persist on the sides of the breast. North Amer. at large, W. to Utah, N. to Hudson's Bay and Labrador, but chiefly Eastern U. S. and Canada; breeding at least from New England northward, wintering entirely in the Southern States. Abundant, but a timid recluse of shrubbery, swamp, and brake, and seldom seen by the *profanum vulgus;* a good musician, like all the genus. Nesting and eggs like those of the song sparrow.

FIG. 233. — Swamp Song Sparrow, reduced. (Sheppard del. Nichols sc.)

244. M. fascia'ta. (Lat. *fasciata*, bundled together; *fascis*, a bundle of rods; *fascia*, a band; whence *fasciata*, banded, striped; the allusion not to the body-streaks, but to the obsolete bands on the tail-feathers. Fig. 234.) SONG SPARROW. SILVER-TONGUE. Below, white, slightly shaded with brownish on the flanks and crissum; with numerous black-centred, brown-edged streaks across breast and along sides, usually forming a pectoral blotch and coalescing into maxillary stripes bounding the white throat; crown dull bay, with fine black streaks, divided in the middle and bounded on either side by ashy-whitish lines; vague brown or dusky and whitish markings on the sides of the head; a brown post-ocular stripe over the gray auriculars, and another, not so well defined, from angle of mouth below the auriculars; the interscapular streaks black, with bay and ashy-white edgings; rump and cervix grayish-brown, with merely a few bay marks; wings with dull bay edgings, the coverts and inner quills marked like the interscapulars; tail plain brown, with darker shaft lines, on the middle feathers at least, and often with obsolete transverse wavy markings. Very constant in plumage, the chief differences being in the sharpness and breadth of the markings, due in part to the wear of the feathers. In worn midsummer plumage, the streaking is very sharp, narrow, and black, from wearing of the rufous and whitish, especially observable below where the streaks contrast with white, and giving the impression of *heavier* streaking than in fall and winter, when, in fresher feather, the markings are softer and more suffuse. The aggregation of spots into a blotch on the middle of the breast is usual. Bill dark brown, paler below; feet pale brown. Length 5.90–6.50, usually 6.30; extent 8.25–9.25, usually 8.50–9.00; wing 2.40–2.75, usually about 2.60; tail nearer 3.00. ♀ averaging near the lesser dimensions, but the species remarkably constant in size, form, and coloring. Eastern U. S. and Canada, breeding through-

out its range, wintering nearly throughout; one of the common winter sparrows of the Middle States. A very abundant bird everywhere in shrubbery and tangle, garden, orchard, and park, as well as swamp and brake. A hearty, sunny songster, whose quivering pipe is often tuned to the most dreary scenes; the limpid notes being one of the few snatches of bird melody that enlivens winter. Nesting various, in a bush near the ground, or a grass tuft, or on the ground: eggs 4–6, 0.75–0.85 × 0.55–0.60, greenish or grayish-white, endlessly varied with browns, from reddish to chocolate as surface-markings, and lavender or purplish shell-markings, either speckled, blotched, or clouded: no general effect describable in few words. Two or three broods may be reared.

245. M. f. fal'lax. (Lat. *fallax*, fallacious, deceitful: well named.) GRAY SONG SPARROW. Extremely similar; the first and least departure from *fasciata*, and scarcely distinguishable; tail rather longer; tone of upper parts paler, grayer; the streaks not so obviously blackish in the centre and with less rufous; obsolete on rump. Southern Rocky Mt. region and Great Basin.

FIG 234. — Song Sparrow, reduced. (Sheppard del. Nichols sc.)

248. M. f. heer'manni. (To Dr. A. L. Heermann.) HEERMANN'S SONG SPARROW. Similar: tone of upper parts grayish, the streaks numerous, broad, distinct, with little rufous and mostly lacking pale edging, obsolete on the rump. Size of *fasciata*. California.

249. M. f. samue'lis. (To E. Samuels.) SAMUELS' SONG SPARROW. Similar to the last, in distinctness of the black streaks, which are not obsolete on rump; tone of upper parts ashy-gray. Very small, scarcely 5.00; wing 2.00; tail 2.30. California coast.

246. M. f. gutta'ta. (Lat. *guttata*, marked with drop-like spots.) OREGON SONG SPARROW. Decidedly different. The streaking diffuse, the streaks above and below dark rufous-brown, without black centres or pale edges. Coloration blended, the general tone ruddy; under parts extensively shaded with brownish, except on belly. About the size of *fasciata*, or rather larger. Pacific coast, U. S. and British Columbia. This form was recognized as distinct by Audubon, who wrongly called it *Fringilla cinerea* Gm.; and by Nuttall, who named it *F. guttata*, and compared it with the fox sparrow, from its resemblance in color to *Passerella iliaca*.

247. M. f. rufi'na. (Lat. *rufina*, reddish.) RUSTY SONG SPARROW. Quite like *guttata;* larger and darker; tone of upper parts smoky-brown, the streaking very dark. Wing and tail about 3.00. Pacific coast, British Columbia and northward. (Combined by Baird with the last, under name of *M. rufina*.)

250. M. cine'rea. (Lat. *cinerea*, ashy.) CINEREOUS SONG SPARROW. KADIAK SONG SPARROW. Peculiar in size, shape, and color. Above, brownish slate-color, more rufous on wings, the streaking broad and blended, very dark. Below, plumbeous-whitish, shaded with brown on sides, the streaks broad, diffuse, and dark. Spring and fall plumages differ much, but the bird may be recognized by its great size. Length about 7.00; wing 3.30; tail 3.50; bill very long, slender for its length; culmen about 0.60; depth at base 0.30. Kadiak, Alaska; Aleutian Islands. (*Fringilla cinerea* Gm. *M. insignis* Bd.)

80. **PEUCÆ'A.** (Gr. πευκή, *peuce*, a pine; not well applied except to *P. æstivalis.*) SUMMER FINCHES. Bill of moderate size, rather elongate-conic, upper mandible declivous toward end, commissure bent. Wings short and much rounded, folding little if any beyond base of tail, the inner secondaries not elongated. Tail little or much longer than wing, much rounded, the lateral feathers some ½ an inch shorter than the middle; of weak narrowly linear feathers with elliptically rounded ends. Feet small and weak, not reaching when outstretched nearly to end of tail; tarsus about equal to middle toe and claw; lateral toes equal, short, their claws not nearly reaching base of middle claw. Adults scarcely or not streaked below; crown chestnut or (oftener) quite like back, streaked with rusty-brown, black, and gray. A superciliary and post-ocular stripe, but usually none running under auriculars; more or less distinct black maxillary stripes. Edge of wing yellow (in most species. These nest on the ground and lay white eggs).

Analysis of Species (adults).

Edge of wing yellow. Crown not uniform chestnut; no chestnut on lesser wing-coverts. Maxillary stripes slight. Nest on ground; eggs white.
- Broadly marked above with rufous streaks or blotches on ashy ground, with black centres of the streaks on middle of back. Tail-feathers plain, or only with obscure whitish area . . *æstivalis* 251–253
- Marked above with pale brown black-centred streaks, these black centres enlarged transversely at their ends on the middle of back. Tail-feathers shafted and barred with blackish, the outer broadly edged and tipped with white . . . . . *cassini* 254

Edge of wing not yellow. Crown chestnut. Maxillary stripes heavy.
- No chestnut on lesser wing-coverts . . . . . *ruficeps* 255–256
- A chestnut patch on lesser wing-coverts . . . . . *carpalis* 257

251. **P. æstiva'lis.** (Lat. *æstivalis*, like *æstivus*, summery; *æstas*, summer.) BACHMAN'S SUMMER FINCH. Upper parts, including crown, continuously streaked with blackish, dull chestnut and ashy-gray; no yellow about head; wing-coverts and inner secondaries marked like the back; edge and bend of wing yellow, as in *Coturniculus passerinus.* Below, dull brownish-ash, or brownish-gray, whitening on the belly, deepest on sides and across breast, nowhere obviously streaked in adult plumage. Some obscure dusky maxillary streaks, some vague dusky markings on auriculars, a slight ashy superciliary line, and very obscure median ashy line on crown. Bill dark above, pale below; legs very pale; lateral claws falling far short of base of middle claw; hind claw much shorter than its digit; tarsus not longer than middle toe and claw; tail much rounded, with obscure grayish-white area on the lateral feathers. *Young* have the breast and sides evidently streaked. Length 5.75–6.20, average 5.90; extent 7.60–8.30, average 8.00; wing 2.17–2.55, average 2.40; tail 2.25–2.68, average 2.50. South Atlantic States, strictly, and especially a bird of pine barrens, common in suitable localities; a fine songster. Nest on the ground, of grasses; eggs 4, 0.75 × 0.60, pure white. As the first described species of the genus, this has been used as a standard of comparison; but it is the *most* modified offshoot of a genus which focusses in the Southwest and Mexico.

252. **P. æ. illinoën'sis.** (Of Illinois.) ILLINOIS SUMMER FINCH. OAK-WOODS SPARROW. Above, sandy-ferruginous, indistinctly streaked with light ashy-gray, the streaks broadest on the back and middle line of crown; interscapulars sometimes with narrow black streaks. Wings light ferruginous, the greater coverts less reddish and edged with paler; inner secondaries dusky, bordered at ends with pale reddish ash. Tail plain grayish-brown, with ashy edgings of the feathers. Sides of head, neck, and body and breast quite across, dingy buff-color, deepest on breast, paler on throat and chin; a post-ocular rusty-brown streak over the auriculars; sides of neck streaked with the same; an indistinct dusky streak on side of throat; belly dull white; crissum buff; edge of wing bright yellow; bill pale horn-color, darkest above; feet pale brown; iris brown. Size of *æstivalis;* wing a little longer, 2.35–2.60, average 2.50; tail 2.55–3.80, average 2.70; bill thicker; black streaks of upper parts, instead of being generally distributed, few and confined to the interscapulars; breast and sides more buffy. Illinois to Texas. (Like *æstivalis* proper, but quite different from any of the following forms.)

253. **P. æ. arizo'næ.** (Of Arizona.) ARIZONA SUMMER FINCH. With a general likeness to *P. æstivalis*, in pattern of coloration, streaking of all upper parts, similarity of back to crown, yellow edge of wing, and plain tail feathers; size same, wing and tail a trifle longer (as in *illinöensis*). Colors duller and less variegated; maxillary stripes obscure or obsolete. Upper parts light dull chestnut or reddish-brown, moderately streaked with plumbeous-gray, but reddish the prevailing tone; interscapular feathers, and sometimes those of the crown, with blackish centres; a poorly defined light superciliary stripe. Beneath, dull whitish, unstreaked, the breast and sides with a decided ochrey-brown tinge. Wings dusky, the inner secondaries darker and with more conspicuous rusty-brown edgings than those of the longer quills, and also some whitish edging or tipping. Bill blackish above, pale below; legs flesh color. Young: above, streaked with blackish and yellowish-gray, showing little reddish; under parts more or less streaked with dusky. Western Texas, New Mexico, Arizona and southward. (This is what I meant by *P.* var. *cassini* of the orig. ed. of the Key; but true *cassini* is entirely different. Var. *arizonæ* is probably identical with *Zonotrichia botterii* Sel.)

254. **P. cas'sini.** (To John Cassin.) CASSIN'S SUMMER FINCH. Belonging to the *æstivalis* group, with yellow edge of wing, and most resembling var. *arizonæ;* but perfectly distinct. A peculiar character of marking raises groundless suspicion of immaturity. ♂ ♀, *adult:* Entire upper parts, from bill to tail, alike in pattern of coloration — a peculiarly intimate variegation of ashy-gray, rufous-brown and blackish — the ruddy color occupying most of the feathers, which have a blackish central field and gray edging; the blackish area on each feather, especially of the back, rump, and upper tail-coverts, where it is most conspicuous, being hammer-headed, or widened toward the end of the feather. Pattern of markings smallest on the cervix. No special head-markings, though there is a tendency toward a lateral browner band on the side of the crown, and browner post-ocular stripe, separated by a gray interval. Variegation of the upper parts descending on sides of neck; sides of head with some vague markings. Innermost secondaries showing quite blackish in the general field of the upper parts, and edged all around with a firm border of ashy-white or hoary-white. Greater and middle coverts exactly like the inner secondaries; primaries similar, but the edging not so clear. Edge of wing clear yellow, and some of the least coverts tinged with this color. Tail curiously particolored; middle pair of feathers light grayish-brown, with a strong dusky shaft-line throwing off numerous dusky cross-bars, so that these feathers seem "watered" with lighter and darker shades. Other tail-feathers, except the outermost pair, are dusky-brown, with pale grayish-brown terminal spots increasing in size from the inner feathers outward. On the outermost feather this pale gray space is very large, and rimmed all around with white. An indistinct maxillary stripe on each side of the chin. A number of strong well-defined dusky stripes on the flanks; otherwise, entire under parts unmarked, and of a dingy whitish color, clearest on the belly and throat, more grayish on the sides and across breast. Bill brown, pale below; feet pale. Length 6.00–6.25; extent about 8.25; wing 2.50; tail 2.75. *Young:* Described as very similar, but with a few drop-shaped streaks on the jugulum and along sides; feathers of upper parts with a more appreciable terminal border of buff. Texas to California, N. to Kansas, S. into Mexico. Habits, nest, and eggs as in *P. æstivalis* (eggs pure white).

255. **P. ru'ficeps.** (Lat. *ruficeps*, red-headed.) RUFOUS-CROWNED SUMMER FINCH. Belonging to a different section of the genus, without any yellow on edge of wing as in the *æstivalis* group and *cassini*. Lesser wing-coverts not chestnut as in *P. carpalis*. Strong maxillary streaks. ♂ ♀, adult: Crown bright chestnut, in perfect condition bright and continuous, blackening on forehead, where divided by a short whitish line (whole cap thus as in *Spizella socialis* or *Melospiza palustris*); crown, however, oftener streaked with olive-ash, especially along a median dividing line, thus assimilating more nearly with colors of other upper parts. An obscure olive-ashy superciliary line, whitening over the lores. Back streaked with olive-ash and chestnut-brown, the latter sometimes distinct, as bold streaking with ashy edging of the

feathers, sometimes spreading almost to extinction of the ashy; and the brown also varying in shade from a kind of purplish-bay to light rusty-brown, apparently according to wear and tear of the plumage. Wings and tail dusky, with varying amount of reddish-brown edgings of the feathers. Under parts dull whitish, strongly shaded with olive-gray or olive-brown, paler on belly, quite whitish on throat, which latter is bounded by strong black maxillary stripes. Size of *P. cassini*, or rather less. *Young:* Crown like back; under parts streaked with dusky, especially the breast. California. Nest and eggs still unknown.

256. **P. r. boucar'di.** (To Adolphe Boucard, a French collector.) BOUCARD'S SUMMER FINCH. From the typical Californian *ruficeps* the Arizona bird is said to differ in being darker, more brownish-plumbeous than olive-ash, the dorsal streaks scarcely rufous, and with black shaft-streaks. Few sparrows, if any, vary more than the species of *Peucæa*, according to mere wear of the feathers, independently of any moult, and to some extent of season. Birds of very different aspect result, and it is not clear how the present alleged variety differs from *ruficeps* proper. OBS. *P. r. eremœca* Brown, Texas, seems scarcely different. *Peucæa* seems to be, like *Junco*, *Melospiza*, *Passerella*, etc., still unstable in its specific differentiations — to be "making species," in fact.

257. **P. carpa'lis.** (Lat. *carpalis*, relating to the *carpus*, or wrist-joint.) BAY-WINGED SUMMER FINCH. Belonging to the section without yellow on edge of wing. Lesser wing-coverts chestnut, forming a patch as conspicuous as in *Pœcetes* or *Auriparus*. Strong black maxillary stripes. Whole crown rufous, or dull bay, divided on forehead by a short pale stripe, and bordered with a pale grayish-ash superciliary stripe. Cervix like crown, but mixed with ashy-gray. Middle of back and scapulars grayish-brown, mixed with a little bay, and sharply streaked with blackish; lower back gray, with little or no black or brown. The general effect of the upper parts, crown, and back, is like that of *Spizella socialis*. Wings and their greater coverts dusky, with grayish-fulvous edging and tipping; primaries and tail-feathers with whitish edging; one or two outer tail-feathers white-tipped. Under parts white, shaded on breast and sides with ashy, the throat pure white, bounded on each side by a sharp black maxillary stripe, above which is another dark line from angle of mouth. Bill apparently reddish flesh color below, dusky above; feet pale brown, the toes rather darker. Length about 6.00; extent 8.50; wing 2.25–2.50; tail 2.75, graduated about 0.50; bill 0.40; tarsus 0.67. Less mature: Crown less different from back, being streaked with ashy, blackish, and rufous. Very young: No chestnut on wing-coverts, and under parts streaked with dusky; thus much like the earliest stage of *Spizella socialis;* after this first stage the chestnut bend of the wing is always conspicuous. Arizona; a very distinct and curious species, lately discovered. Farther peculiar in nesting in bushes and laying a greenish egg, all the other *Peucææ*, as far as known nesting on ground and laying pure white eggs. (*P. ruficeps*, however, is not yet known in this particular.) Eggs 4–5, 0.72 × 0.58, June–September; nest in a fork of bush, deeply cupped, of grasses, rootlets, and hairs.

81. **AMPHISPI'ZA.** (Gr. *ἀμφί, amphi*, on both sides; *σπίζα, spiza*, a finch: alluding to the close relation of the genus to those about it.) SAGE SPARROWS. Bill moderate, conical, not peculiar. Wings folding considerably beyond the base of the tail, without elongated inner secondaries; point of wing formed by 2d–5th quill, the 1st between 6th and 7th. Tail not shorter than wings, of rather broad firm feathers, rounded at ends. Tarsus longer than middle toe and claw; lateral toes of unequal lengths, the outer (longer) not reaching to base of middle claw. Embracing two Southwestern species, with rounded blackish tail not shorter than the wings, plumbeous-black bill and feet, and few decided streaks, or none. These do not particularly resemble each other, and might not necessarily be associated; nor is the genus well characterized, though different from the exotic *Poospiza* to which the species were formerly referred. The larger one of the two species, *A. belli*, is sometimes placed in the genus *Zonotrichia*.

Analysis of Species.

Adult with throat black, sides not streaked, and no yellow on edge of wing . . . . . *bilineata* 258
Adult with throat white, sides streaked, and yellow on edge of wing.
Smaller: wing and tail under 3.00; dorsal streaks obsolete . . . . . *belli* 259
Larger: wing and tail 3.00 or more; dorsal streaks distinct . . . . . *nevadensis* 260

258. A. bilinea'ta. (Lat. *bilineata*, two-lined; *bis*, twice, *linea*, a line; alluding to the stripes on the head. Fig. 235.) BLACK-THROATED FINCH. BLACK-FACED SAGE SPARROW. ♂ ♀, adult: Face, chin, and throat sharply jet-black; a strong white superciliary line, and another bounding the black of the throat; under eyelid white; auriculars dark slate. No yellow anywhere. Below, pure white; the sides, flanks, and crissum shaded with ashy or fulvous-brownish, but no streaks. Above, uniform grayish-brown; clearer ash in high plumage, otherwise browner, generally more ashy anteriorly than behind, and shading insensibly into the black of the face. Wings dusky; coverts and inner quills edged with the color of the back. Tail black, with narrow grayish edgings; the outer feather sharply edged and tipped with white, and several others similarly tipped. Bill and feet plumbeous-black. Small: length about 5.50; wing about 2.50; tail 2.75. Young: The head-markings obscure; little or no black on throat; a few pectoral streaks. Owing to absence of black on the throat, the white maxillary stripe is ill-defined, but the other stripe is conspicuous. Back rather brown than ashy; tail blackish, not pure black. A jaunty little sparrow, haunting the sage-brush and chaparral of the southwest, from Texas to California, N. to Utah and Nevada or farther, migratory northerly. An effective songster. Nest in bushes close to the ground; eggs 4–5, 0.72 × 0.58, whitish, unmarked.

FIG. 235.— Black-throated Finch, reduced. (Sheppard del. Nichols sc.)

259. A. bel'li. (To J. G. Bell, of N. Y.) BELL'S FINCH. CALIFORNIA SAGE SPARROW. No definite black about head, and edge of wing slightly yellowish. Forehead, line over eye, and edges of eyelids, inconspicuously white. Below, white, more or less tinged with pale brownish, the sides with slight sparse streaks that anteriorly become aggregated into slight maxillary stripes cutting off from the white throat a whitish line that runs from the corner of the bill; lores and circum-ocular region dusky. Above, grayish-brown, ashier on head, the middle of the back with small obscure blackish streaks; wing-coverts and inner quills with much fulvous edging; tail black with slight pale edgings, the outer web of the outer feather simply whitish. Bill and feet plumbeous-blue. Length under 6.00; wing and tail under 3.00. Southern California, resident. Nest in low bushes or on the ground; eggs greenish-blue, speckled.

260. A. b. nevaden'sis. ARTEMISIA SPARROW. NEVADA SAGE SPARROW. Similar to the last in coloration. Edge of wing, and sometimes the lesser coverts, yellowish. Above, ashy-brown, much as in *P. bilineata*, clearer ash anteriorly, more brownish behind; also clearer in high plumage, and more overcast with brown in less mature specimens; the middle of the back and the scapulars very notably streaked with fine black lines. Below, white; the sides and sometimes, especially in fall specimens, most of the under parts shaded with pale fulvous-brown; the sides, and sometimes the breast, with dusky streaks, which on the side of the neck tend to run in a chain, partly distinguishing a pure white lateral stripe above them from the general whitish of the under parts. Sides of head slaty, becoming dusky on lores; a conspicuous white eye-ring. A short white line above lores, and another on middle of forehead. Wings and tail as in the last; outer feather edged and tipped with white. Bill dark bluish-plumbeous, under

mandible sometimes yellowish. Decidedly larger than *belli* proper, though so little different in color; wing and tail fully 3.00, if not more; bill 0.35; tarsus 0.75. Southern Rocky Mt. region, N. to 40° and beyond, resident; abounding in the sage-brush deserts of Nevada, Utah, New Mexico and Arizona. Nesting as in *P. belli;* eggs 0.80 × 0.60, pale greenish, profusely speckled with reddish-brown and blackish-brown, with purplish shell-markings.

82. **JUN'CO.** (? Lat. *juncus*, a reed.) Snow Sparrows. Snow-birds. Bill small, strictly conic. Wings rather long, the primaries much surpassing the short inner secondaries in the closed wing; usually 2d, 3d, and 4th quills longest, 5th little shorter, then 1st and 6th. Tarsus a little longer than middle toe and claw; lateral toes subequal, their claws about reaching base of middle claw. Tail about as long as wings, slightly emarginate or about even, of rather narrow but firm feathers, rounded oval at ends. A beautiful genus; adults unspotted, unstreaked, the colors massed in large definite areas; belly, crissum, and 2–3 lateral tail-feathers white; bill whitish, or black and yellow. Length 6 or 7 inches; wing and tail about 3 inches. Sexes subsimilar, but ♂ clearer and purer in coloration; young entirely different, quite streaky. Nest on the ground; eggs speckled. One common Eastern species; in the West the *Junco* stock split into numerous forms, all of which intergrade with each other, and with the Eastern bird. Almost all late writers have taken a hand at *Junco*, shuffling them about in the vain attempt to decide which are "species" and which "varieties." All are either, or both, as we may elect to consider them; for the degree of difference between almost any two of the nearest related ones is about the same. The distinctions between the typical styles of each are very nice and easily perceived. The theory of hybridization advanced to account for the connecting links simply restates without explaining the case; for interbreeding is just one of the conditions of intergraded species, keeping them from positive distinctness. Upon this understanding the recognizable styles of *Junco* may all be treated alike. *Adult male* birds of the several forms afford the following

Analysis of Species or Subspecies.

Bill flesh-color.
- Blackish-ash, without reddish tints; sides ashy.
  - No white wing-bars . . . . . *hiemalis* 261
  - Two white wing-bars . . . . . *aikeni* 262
  - (mixed characters of first and next . . . . . *connectens* 262*a*
- Sooty-black on head and breast; back reddish; sides pinkish . . . . . *oregonus* 263
  - (mixed characters of last and next . . . . . *annectens* 264
- Ashy on head and breast; interscapulars alone reddish . . . . . *caniceps* 265

Bill black and yellow.
- (mixed characters of last and next . . . . . *dorsalis* 266
- Ashy on head and breast; interscapulars and wing-coverts reddish . . . . . *cinereus* 267

Setting aside *aikeni* as a special offshoot, we have *hiemalis* connected with *oregonus* by birds possessing pink sides and ashy back, or reddish back and ashy sides; this style may be named *connectens*. Similarly, *oregonus* and *caniceps* are annexed by gray-headed red-backed birds with pink sides; this is *annectens*. And again, but more remarkably, the pink-billed *caniceps* is affixed with the black-and-yellow-billed *cinereus* by *dorsalis*, which has the bill of the latter, but otherwise resembles the former.

261. **J. hiema'lis.** (Lat. *hiemalis*, wintry; *hiems*, winter. Fig. 236.) Eastern Snow-bird. Black Snow-bird. Blackish-ash, below abruptly pure white from the breast, the sides shaded with ashy. In the ♀, and most fall and winter specimens, the upper parts have a more grayish, or even a decidedly brownish, cast, and the inner secondaries are edged with pale bay. ♂, in full dress: The slaty-black intense on the head; belly and crissum pure white, the line between the two transverse or convex forward; wings and tail blackish, with slightly hoary edging of some of the feathers; 2–3 lateral tail feathers pure white, wholly or in greatest part. No rusty-brown on back or sides; any shade on the sides ashy, not pinkish. Bill pinkish-white, or flesh-color, usually black-tipped. Length 6.00–6.50; extent 9.50–10.00; wing 3.00–3.25; tail rather less. These extremes uncommon; average 6.25—9.75—3.10. ♀, in summer: The

slate-color less intense, overlaid with brown (not reddish), sometimes quite brown; edging of inner secondaries rusty-brown; average less white on the tail; rather smaller; average about at the lesser of the above dimensions: sometimes only 5.75—9.25—2.75. ♂ ♀, in winter: Resembling the ♀ in summer. Young of the year: The general color rather brown than slate, with conspicuous bay edgings of inner secondaries; bill much obscured with dusky. The brown overcast, it should be observed, is a general shading, not of particular areas, and not pinkish. Young before first moult: Entirely streaked and spotted, like most very young sparrows. Upper parts streaked with blackish and rusty-brown, the secondaries and wing coverts conspicuously edged with the latter. Under parts streaked or speckled with dusky and ochrey brown, on all the fore parts and sides, the belly and crissum soiled whitish. Bill dusky, paler below. Eastern N. Amer., N. W. to Alaska, W. to the Rocky Mts. and even Utah and Washington Territories; still chiefly Eastern. One of our most abundant and familiar winter birds, in flocks in the shrubbery, from October to April. Retires to high latitudes or altitudes to breed. Nests in mountains of the Middle and some of the Southern States, as Virginia and North Carolina, and down to sea level from the limits of the Canadian fauna in Maine; winters anywhere in the U. S., most numerously from Massachusetts southward; a cheery bright little bird, coming fearlessly to the threshold and window-sill in bad weather. Its snapping note is better known than is the pleasant song with which it takes leave in the spring. Nest on the ground; eggs 4–6, white, sprinkled with reddish and darker brown dots, about 0.80 × 0.60.

FIG. 236. — Eastern Snow-Bird. (Sheppard del. Nichols sc.)

262. J. h. ai'keni. (To C. E. Aiken, of Colorado.) WHITE-WINGED BLACK SNOW-BIRD. Like the last: the wings crossed with two white bars formed by the tips of the greater and middle coverts; and sometimes white edging of the inner secondaries. Rather large. Mts. of Colorado.

262a. J. h. connec'tens. (Lat. *connectens*, connecting; *con*, with, *necto*, I join.) HYBRID SNOW-BIRD. Possessing in varying degree the characters of *hiemalis* and *oregonus;* rufous back of the latter and ashy sides of the former, or, oftener, the ashy back of the former and pink sides of the latter; occurring wherever the breeding range of the two comes together, and elsewhere during the migration.

263. J. h. ore'gonus. (Lat. of the Oregon River.) OREGON SNOW-BIRD. Head and neck all round and fore breast sooty-black, ending sharply against white with a rounded outline convex backward; middle of back dull reddish-brown, and feathers of the wings much edged with the same; below from the fore breast abruptly white, tinged on the sides with pale reddish-brown — a peculiar "pinkish" shade. Bill white, black-tipped. In the ♀ and young the black is obscured by brownish, but the typical form may always be distinguished by an evident contrast in color between the interscapulars and head, and the fulvous or pinkish wash on the sides. The season and sexual changes of plumage are parallel with those of *hiemalis*. A specimen examined by me has imperfect white wing-bars, like *aikeni*. Rocky Mts. to the Pacific; as abundant there as *hiemalis* is with us, and thence straggling eastward; has occurred in Massachusetts; N. to Alaska. In the U. S. it is less obviously migratory than *hiemalis*, owing to the broken mountainous regions it inhabits.

264. J. h. annec'tens. (Lat. *annectens*, annexing; *ad*, to, and *necto*, I join.) PINK-SIDED SNOW-BIRD. Characters in general of *J. caniceps* (No. 265); differs by more abrupt definition of the white belly from the ashy breast, and pinkish sides: by so much resembling *oregonus*. Southern Rocky Mt. region, from Wyoming, and especially Colorado, to New Mexico and Arizona; migrating latitudinally with season, but chiefly working up and down the mountains.

265. J. h. ca'niceps. (Lat. *caniceps*, gray-headed; *canus*, gray.) GRAY-HEADED SNOW-BIRD. Clear ash, purest on head, paler below, and fading gradually into white on belly; interscapulars abruptly, definitely, chestnut or rusty-brown; lores blackish; bill flesh-color; iris brown; no fulvous wash on sides; no chestnut on wings in the typical form. Rather larger than *hiemalis;* length about 7.00; wing over 3.00; tail about 3.00. The sexual and seasonal changes are not so well marked as in the heavily-colored *hiemalis* and *oregonus*, but parallel as far as they go. Very young birds are streaked, like all the rest. Rocky Mts. of the U. S., from Wyoming southward; Wahsatch and Uintah Mts. Five or six of the styles of *Junco*, including *J. hiemalis*, occur together in the mountains of Colorado, New Mexico, and Arizona.

266. J. h. dorsa'lis. (Lat. *dorsalis*, pertaining to the back; *dorsum*, the back.) RED-BACKED SNOW-BIRD. Characters in general of *J. caniceps;* but with the bill black and yellow, as in *cinereus*. Mountains of New Mexico and Arizona.

267. J. h. cine'reus. (Lat. *cinereus*, ashy; *cinis*, ashes.) CINEREOUS SNOW-BIRD. MEXICAN SNOW-BIRD. Like *J. caniceps*. Under parts paler ash, fading sooner and more insensibly into white; chestnut of back intense, and spreading over the wing-coverts and inner secondaries; upper mandible black; lower yellow; iris yellow. Mexico to the U. S. border. Mt. Graham, Arizona.

83. SPIZEL'LA. (Ital. diminutive form of Lat. *spiza*, from Gr. *σπίζα*, a finch.) CHIPPING SPARROWS. Embracing small species, 5–6 inches long, with the long, broad-feathered, forked tail about equalling (more or less) the rather pointed wings; with no yellowish anywhere, and no streaks on the under parts *when adult;* interscapular region distinctly streaked; rump plain (except *atrigularis*); *young* fully streaked. Point of wing formed by 2d to 4th or 5th quill; 1st usually between 5th and 6th. Bill small, conic. Tarsus little if any longer than middle toe and claw; lateral toes about equal. Tail-feathers widening a little to broadly oval tips. Numerous species, Eastern and Western, inhabiting shrubbery; three of them familiar Eastern birds.

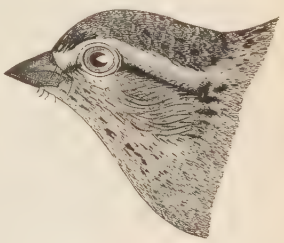


FIG. 237. — Chippy's head, as large as life. (E. C.)

Analysis of Species.

Eastern and Western species with the crown *of the adult* chestnut.
- Bill black and yellow; forehead not black; two distinct white wing-bars; dark spot on breast; large: about 6.00 long . . . . . *monticola* 268
- Bill and forehead black; wing-bars not conspicuous; breast ashy-white, without spot; length under 6. Tail decidedly shorter than wing . . . . . *domestica* 269, 270
- Bill brownish-red; forehead not black; wing-bars indistinct; breast buffy white, without spot. Length under 6.00 . . . . . *agrestis* 271

Western species, with the crown not chestnut, and streaked like the back.
- Crown divided by a median stripe, and its streaks separated from those of the back by an ashy interval. Tail equal to wings . . . . . *pallida* 272
- Crown not evidently divided, and streaked continuously with the back. Tail longer. . . . *breweri* 272

Western species, with the crown of the adult dark ash. Face and throat black. Tail decidedly longer than wing . . . . . *atrigularis* 274

268. S. monti'cola. (Lat. *monticola*, inhabiting mountains; *mons, montis*, a mountain; *colo*, I dwell; *incola*, an inhabitant.) TREE SPARROW. WINTER CHIP-BIRD. Bill black above, yellow below; legs brown; toes black. No black on forehead; crown chestnut (in winter specimens the feathers usually skirted with gray), bordered by a grayish-white superciliary and loral line; a postocular chestnut stripe over auriculars, and some vague chestnut marks on

cheeks; sides of head and neck otherwise ashy-gray. Below, impurely whitish, tinged with ashy anteriorly, washed with pale brownish posteriorly, the middle of the breast with an obscure dusky blotch. Middle of back boldly streaked with black, bay, and flaxen; middle and greater wing-coverts black, edged with bay and tipped with white, forming two conspicuous cross-bars; inner secondaries similarly variegated; other quills and tail-feathers plain dusky, with pale or whitish edges. Remarkably constant in coloration; sexes indistinguishable, and young very similar, the chief variation being in the veiling of the cap with gray. There is a very early streaky stage, however, as in other species. A handsome sparrow, the largest of the genus. Length 5.80–6.20, usually 6.00; extent 8.75–9.75, usually 9.25; wing and tail 2.75–3.10. Abundant in the U. S. in winter, flocking in shrubbery; breeds in mountainous and boreal regions, even to the Arctic coast. Infrequent or casual west of the Rocky Mts. Nest in low bushes or on the ground, loosely constructed of bark-strips, weeds, and grasses, warmly lined with feathers. Eggs 4–6 or even 7, pale green, minutely and regularly sprinkled with reddish-brown spots.

269. S. domes'tica. (Lat. *domestica*, domestic. Figs. 237, 238.) CHIPPING SPARROW. CHIP-BIRD OR CHIPPY. HAIR-BIRD. Adult: Bill black; feet pale; crown chestnut; extreme forehead black, usually divided by a pale line; a grayish-white superciliary line; below this a blackish stripe through eye and over auriculars; lores dusky. Below, a variable shade of pale ash, nearly uniform and entirely unmarked; back streaked with black, dull bay and grayish-brown; inner secondaries and wing-coverts similarly variegated, the tips of the greater and median coverts forming whitish bars; rump ashy, with slight blackish streaks or none; primaries and tail-feathers dusky, with paler edges. Smaller: length 5.00–5.50; extent 8.00–9.00; wing 2.66–2.75; tail less, about 2.50. Sexes alike, but very young birds quite different; the crown being streaked like the back, the breast and sides thickly streaked with dusky, the bill pale brown, and the head lacking definite black. In this stage, which, however, is of brief duration, it resembles some other species, but may be known by a certain ashiness the others lack, and from the small sparrows that are streaked below when adult, by its generic characters. North America, extremely abundant, and the most familiar species about houses, in gardens, and elsewhere, nesting in shrubbery; nest of fine dried grass, lined with hair; eggs 4–5, bluish, speckled sparsely and chiefly about the larger end with blackish-brown, with purplish shell-markings; size about 0.70 × 0.55.

FIG. 238. — Chipping-Sparrow, reduced (Sheppard del. Nichols sc.)

270. S. d. arizo'næ. (Lat. of Arizona.) ARIZONA CHIPPING SPARROW. Like an immature *S. domestica*. Paler than this species, the ashiness in great measure brown; crown grayish-brown streaked with dusky like the back, and showing evident traces of rich chestnut, but never becoming wholly chestnut; black frontlet lacking or obscure, and no definite ashy superciliary line, the sides of the crown merely lighter brown; bill brown above, pale below. Arizona, and other portions of the Southern Rocky Mt. region. A curious form, as it were an arrested stage of *domestica*. Some specimens, with the least chestnut on the head, look remarkably like *breweri*, but this last is evidently smaller, without chestnut on the head, and otherwise different.

271. S. agres'tis. (Lat. *agrestis*, pertaining to fields; *ager*, a field.) FIELD SPARROW. Bill pale reddish; feet very pale; crown dull chestnut; auriculars and postocular stripe the same; no decided black or whitish about head. Below, white, unmarked, but much washed with pale brown on breast and sides; sides of head and neck with some vague brown markings; all the

ashy parts of *domestica* replaced by pale brownish. Back bright bay, with black streaks and some pale flaxen edgings; inner secondaries similarly variegated; tips of median and greater coverts forming whitish cross-bars. Size of *domestica*, but more nearly the colors of *monticola*. Length 5.25–5.75; extent 7.75–8.40; wing 2.30–2.50; tail quite as much, or more, thus not shorter than wing, as it is in the last. Sexes alike; young for a short time streaked below, as usual in *Spizella*. Eastern U. S., strictly; hardly N. throughout New England, W. only to the edge of the Plains; migratory; breeds usually from Virginia northward, and winters from the same southward; very abundant in fields, copses, and hedges, in flocks when not breeding. Nest indifferently in low bushes or on ground; eggs whitish, fully speckled with rusty-brown, 0.68×0.50.

272. **S. pal'lida.** (Lat. *pallida*, pale.) CLAY-COLORED SPARROW. Crown and back clay-colored or flaxen, distinctly streaked with black, without evident bay, the dorsal streaks noticeably separated from those of the crown, by an ashier, less streaked, cervical interval; rump brownish-gray. Crown divided by a pale median stripe; a distinct whitish superciliary line; loral and auricular regions decidedly brown, with a dark postocular stripe over the auriculars, and another from the angle of the mouth, bounding the brown area inferiorly; below this a dusky maxillary streak; wing-coverts and inner secondaries variegated like the back, being black with broad flaxen-brown edging and whitish tipping. Below, white, soiled with clay-color. Bill dusky above, pale below; feet pale. Small: Length 5.00–5.25, rarely 5.50; extent 7.40–7.75, rarely 8.00; wing and tail, each, about 2.50. Young birds lightly streaked below. Central region of the U. S. into British America, Saskatchewan and Red River regions; S. to Texas; E. to Iowa and Illinois. Abundant; nest in bushes close to ground; eggs 3–4, pale green sparsely speckled with rich brown; 0.62×0.50.

273. **S. brew'eri.** (To Dr. T. M. Brewer, of Boston.) BREWER'S SPARROW. Similar; paler and duller, all the markings indistinct; streaks of crown and back small, numerous, not separated by a cervical interval; no definite markings on sides of head. Upper parts grayish-brown, with marked dorsal area of brighter brown, and continuously streaked from head to tail. Size of the last, but tail relatively longer, exceeding the wings — about 2.66 long, thus equalling, if it does not somewhat exceed, that of *domestica*, although the latter is a larger bird. Southwestern U. S., especially New Mexico and Arizona; said to have occurred in Massachusetts; habits those of *pallida;* nest and eggs indistinguishable.

274. **S. atrigula'ris.** (Lat. *atrigularis*, black-throated; *ater*, black; *gula*, throat.) BLACK-CHINNED SPARROW. ♂, adult: Dark ash, fading insensibly into whitish on the belly, deepening to black on the face and throat; interscapulars bright bay, streaked with black; wing-coverts and inner secondaries variegated with the same colors; tail blackish, with pale edgings; bill coral red as in *S. agrestis;* feet dark brown. A small-bodied species, but full 6.00 long, on account of the great length of the tail (2.75–3.00), which much exceeds the wings (2.25-2.50; extent 7.75). The young lack black on the face, have the crown washed with ashy-brown, the middle of the back duller chestnut, and the bill dusky above; but may be known by the length of the tail. Mexico, Lower California, Arizona.

FIG. 239. — Crown Sparrow (white-throated), nat. size. (Ad. nat. del. E. C.)

FIG. 240. — Crown Sparrow, (white-crowned), nat. size. (Ad. nat. del. E. C.)

84. **ZONOTRICH'IA.** (Gr. *ζώνη, zone*, a girdle, band; *τριχιάς, trichias*, name of a bird. Figs. 239, 240.) CROWN SPARROWS. Embracing our largest and handsomest sparrows, 6.50 to

7.50 inches long, the rounded wings and tail each 3.00 or more; the under parts with very few streaks, or none, the middle of the back streaked, the rump plain, the wings with two white cross-bars, the head of the adults with black, and usually with white and yellow also, or both. Bill moderate, conical, culmen and gonys just appreciably curved, commissure very little angulated. Point of the wing formed usually by the 2d–4th quills, and 1st about equal to 5th; folding decidedly beyond the inner secondaries, and to near the middle of the tail. Tail-feathers of moderate width and consistency, rounded oval at the end; tail as a whole rounded. Tarsus about equal to middle toe and claw; lateral toes about equal to each other. The Crown Sparrows are peculiar to North America, where they are represented by five beautiful and perfectly distinct species.

Analysis of Species (adults only).

Crown black and white; no yellow on head; throat ash.
- Lores black. Dorsal streaks purplish-bay; no yellow on wing . . . . . *leucophrys* 276
- Lores gray. Dorsal streaks purplish-bay; no yellow on wing . . . . . *intermedia* 277
- Lores gray. Dorsal streaks sooty-black; edge of wing yellowish . . . . . *gambeli* 278

Crown black and white; yellow spot before eye; throat white; edge of wing yellow . . . . . *albicollis* 275

Crown black, yellow and ash; edge of wing yellow; throat ashy . . . . . *coronata* 279

Crown, face, and throat black; no yellow on head or wing . . . . . *querula* 280

275. Z. albicollis. (Lat. *albicollis*, white-throated; *albus*, white; *collum*, neck. Fig. 241.) White-throated Crown Sparrow. Peabody-bird. Adult ♂: Crown black, divided by a median white stripe, bounded by a white superciliary line, and *yellow spot* from nostril to eye; below this a black stripe through eye; below this a maxillary black stripe bounding the definitely pure white throat, sharply contrasted with the dark ash of the breast and sides of the neck and head. *Edge of wing yellow.* Back continuously streaked with black, chestnut, and fulvous-white; rump ashy, unmarked. Wings much edged with bay, the white tips of the median and greater coverts forming two conspicuous bars; quills and tail-feathers dusky, with pale edges. Below, white, shaded with ashy-brown on sides, the ash deeper and purer on the breast; bill dark; feet pale. ♀, and immature birds, and specimens as generally seen in the U. S. in fall and winter, with the black of the head replaced by brown, the white of the throat less conspicuously contrasted with the duller ash of surrounding parts, and frequently with obscure dusky streaks on the breast and sides; but the species may always be known by the yellow over the eye and on the edge of the wing (these never being imperceptible), coupled with the large size and the generic characters. Length 6.50–6.90; extent 9.20–9.90; wing 2.75–3.00; tail about the same. A fine sparrow, abundant throughout Eastern N. Am. to latitude 65° N.; W. to Dakota; breeds from the New England and other Northern States northward; winters from the Middle States southward. Found in all situations, but especially in shrubbery, generally in flocks, except when breeding; a pleasing if not brilliant songster, with its limpid *pea-peabody, peabody, peabody* in cadence. Nest on the ground, rarely in bushes; eggs 4–6, about 0.90 × 0.66, with the endless diversity of tone and pattern of those of the song sparrow, from which they are only distinguished by their greater size.

Fig. 241. — White-throated Crown Sparrow, reduced. (Sheppard, del. Nichols sc.)

276. Z. leuco'phrys. (Gr. λευκός *leucos*, white; ὀφρύς, *ophrus*, eyebrow. Fig. 242.) WHITE-BROWED CROWN SPARROW. ♂ ♀, adult: Crown pure white, enclosing on either side a broad black stripe that meets its fellow on the forehead and descends the lores to the level of the eyes, and bounded by another narrow black stripe that starts behind the eye and curves around the side of the hind-head, nearly meeting its fellow on the nape; edge of under eyelid white. Or, we may say, crown black, enclosing a median white stripe and two lateral white stripes, all confluent on the hind head. No yellow anywhere. General color a fine dark ash, paler below, whitening insensibly on chin and belly, more brownish on the rump, changing to dull brownish on the flanks and crissum, the middle of the back streaked with dark purplish-bay and ashy-white. No bright bay, like that of *albicollis*, anywhere, except some edging on the wing-coverts and inner secondaries; middle and greater coverts tipped with white, forming two bars. Bill and feet reddish. Length 6.25–7.00; extent 9.20–10.20; wing and tail 2.90–3.20; usually 6.75—9.50—3.10. Young: Black of the head replaced by very rich warm brown, the white of the head by pale brownish; the general ash has a brownish suffusion, and the back is more like that of *albicollis*, being streaked with dusky and ochrey-brown; but the two species cannot be confounded. Very young: Before the first moult, there are indications of the head markings as last described; but the whole upper parts, sides of the neck and fore under parts are streaked with blackish and ochrey-brown or whitish. North Amer., especially eastern and rather northerly; W. to the Rocky Mts., where mixed with *Z. l. intermedia;* Greenland; Cape St. Lucas. Not nearly so abundant in the U. S. as *albicollis*, but common in many sections in winter and during the migrations. Breeds occasionally in Northern New England, and plentifully in Labrador, where it is one of the commonest sparrows. Nesting the same as that of *albicollis*, and eggs undistinguishable.

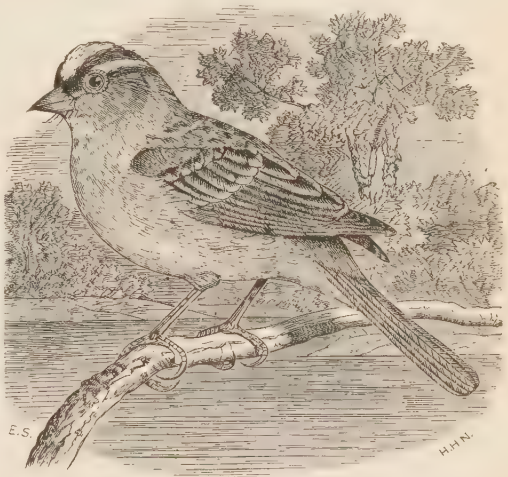


FIG. 242. — White-browed Crown Sparrow, reduced. (Sheppard del. Nichols sc.)

277. Z. l. interme'dia. (Lat. *intermedia*, intermediate, in the middle.) INTERMEDIATE CROWN SPARROW. Exactly like the last, but lores gray or ashy, continuous with the white stripe over the eye, *i. e.*, the black of the forehead does not descend to the eye. Perhaps averaging a trifle smaller, and duller colored. Some specimens resemble *leucophrys* on one side of the head, and *intermedia* on the other. Rocky Mts. to the Pacific, mostly replacing true *leucophrys*. (*Z. gambeli* Bd., 1858, Coues, 1872, *nec* Nutt.)

278. Z. gam'beli. (To Wm. Gambel, of Phila.) GAMBEL'S CROWN SPARROW. Markings of the head much the same as in *Z. l. intermedia;* body colors entirely different, and almost exactly as in *coronata*, No. 279. Streaking of the back sooty-black. Edge and lining of the wing yellow, as in *coronata* and *albicollis*. Bill in dried specimens blackish and yellow, not reddish. Size of *coronata*. Pacific coast, U. S., southerly. (*Z. gambeli* Nutt., 1840, *nec* Baird, Coues.)

279. Z. corona'ta. (Lat. *coronata*, crowned; *corona*, a crown.) GOLDEN CROWN SPARROW. ♂ ♀, adult: Forehead and sides of the crown black, enclosing a dull yellow coronal patch anteriorly, an ashy one posteriorly; a yellow spot over eye; lores black. Edge of the wing yellow. Above, much like *albicollis*, but with less bay and no whitish; two white wing-bars. Below, including sides of head and neck, ashy, passing insensibly into whitish on the belly, and much shaded with brownish on the flanks and crissum; thus much like *leucophrys*, but the

ashy not so pure; larger than *leucophrys;* length averaging 7.00; wing over 3.00. *Young:* black of the crown replaced by brown; but always traces of the yellow on crown and wings. The yellow eye-spot is small, and not always evident. Pacific coast (to the Rocky Mts. from Alaska to Southern California, abundant, migratory.

280. Z. que'rula. (Lat. *querula,* querulous, plaintive; *queror,* I complain, lament.) HOODED CROWN SPARROW. HARRIS' SPARROW. Adult ♂, in breeding plumage: Whole crown, face, and throat jet-black; sides of head pale ash; auriculars darker ash, bounded by a black line starting behind the eye and curving around them. Under parts nearly pure white, but slightly ashy before and faintly brownish-washed behind, the sides with a few dusky streaks, the breast with a few black spots continued from the black throat-patch. Back nearly as in *coronata,* streaked with dusky and reddish-brown. Bill coral-red; toes dark; tarsi pale. No yellow anywhere. Very large: Length 7.00–7.75; extent 10.75–11.25; wing 3.25–3.50; tail 3.40–3.60; bill 0.45; tarsus 1.00; middle toe and claw rather less. ♀ similar, but with much less black on head and throat, the hood being restricted or imperfect; but its outline usually traceable. ♂ ♀, in the fall: Bill light reddish-brown, usually obscured on ridge and at tip, and paler at base below; feet flesh-colored, obscured on the toes; eyes brown. Crown grayish-black, every feather with a distinct, narrow, pale gray edge all around, producing a peculiar effect; this area bounded with a light ochrey-brown superciliary and frontal line. Sides of head like the superciliary, but the auricular patch rather darker grayish-brown, and the loral region obscurely whitish. Chin pure white, bounded on each side by a sharp maxillary line of blackish, with a rusty-red tinge. On the lower throat, a large, diffuse and partially discontinuous blotch of this same blackish-red, cutting off the white chin from the white of the rest of the under parts, connecting with the maxillary streaks, and stretching along the sides of the neck and breast in a series of rich dusky-chestnut streaks. On the middle of the breast the blotch generally runs out into the white in a sharp point, but its size and shape vary interminably. The markings here described are all included in the jet-black hood and breast-plate of the perfect spring dress; and between the two extremes every intermediate condition may be observed at various seasons. The rest of the plumage does not differ very materially from that of the adult ♂ in summer. This is the largest of our sparrows; a bird of imposing appearance — for a sparrow. Interior U. S. and British Provinces, especially the valley of the Mississippi, Lower Missouri, and Red River of the North; scarcely W. to the Rocky Mts.? E. to Minnesota, Missouri, Iowa, and probably Illinois; S. to Texas. It is abundant in the line of its migration, as in Kansas, Nebraska, Iowa, Dakota, etc., but its breeding resorts are still unknown. I found it in Dakota at 49° coming early in September from the North.

85. CHONDES'TES. (Gr. χόνδρος, *chondros,* cartilage; also grain, seeds; ἐδεστής, *edestes,* an eater; badly formed.) LARK SPARROWS. Framed for a single species, with long pointed wings exceeding the long rounded tail; point of the wing formed by 2d and 3d primaries, but 1st and 4th scarcely shorter; rest rapidly graduated. Tarsus about equal to middle toe and claw; lateral toes short, tips of the claws not reaching base of middle claw. Bill swollen-conic, with culmen slightly convex, and commissure little angulated. Species large, for a sparrow, streaked above, white below, the head and tail parti-colored.

FIG. 243. — Lark Sparrow, nat. size. (Ad nat. del. E. C.)

281. C. gram'mica. (Gr. γραμμικός, *grammicos,* marked with a γράμμα, *gramma,* a line, word; badly selected to indicate the stripes of the head. Fig. 243.) LARK SPARROW. LARK FINCH. ♂ ♀, adult: Head variegated with chestnut, black, and white; crown chestnut, blackening on forehead, divided by a median stripe, and bounded by superciliary stripes, of

white; a black line through eye, and another below eye, enclosing a white streak under the eye and the chestnut auriculars; next, a sharp black maxillary stripe not quite reaching the bill, cutting off a white stripe from the white chin and throat. A black blotch on middle of breast. Under parts white, faintly shaded with grayish-brown; upper parts grayish-brown, the middle of the back with fine black streaks. Tail very long, its central feathers like the back, the rest jet-black, broadly tipped with pure white in diminishing amount from the lateral pair inward, and the outer web of the outer pair entirely white. Length 6.50–7.00; wing 3.50, pointed; tail 3.00, rounded. Very young: Crown, back, and nearly all the under parts streaked with dusky; no chestnut on head, nor are the black stripes firm; but with the first moult the peculiar pattern of the head-markings becomes evident, and there is little variation afterward with age, sex, or season. A beautiful species, abundant from the eastern edge of the prairies, and even Iowa and Illinois, to the Pacific, U. S.; occasional in Ohio, and stragglers have been taken in Massachusetts and about Washington. A sweet songster; breeds throughout its range; nest usually on the ground, of dried grass; eggs 4–7, white, with straggling zigzag dark lines, as in many *Icteridæ;* size 0.75–0.85 by about 0.65.

86. **PASSEREL'LA**. (Ital. diminutive form of Lat. *passer*, a sparrow.) Fox Sparrows. Remarkable for the size of the feet and claws: Lateral toes elongated to about equal degree, the ends of their claws reaching about half-way to the end of the middle claw; claws all very large; middle toe and claw about as long as the tarsus. Wings long and pointed, folding about to the middle of the tail; point formed by the 2d–4th quills, 1st and 5th little shorter. Tail moderate, a little rounded or nearly even. Bill rather small, strictly conic, with straight outlines and scarcely angulated commissure. Large handsome reddish or slate-colored species, marked below with triangular spots and streaks of the color of the back. Habits terrestrial and somewhat rasorial. Nest indifferently in trees or bushes or on the ground; eggs greenish, fully speckled. The species, if more than one, are, like those of *Junco*, *Melospiza*, and *Pipilo*, still imperfectly differentiated.

Fig. 244. — Bill of Fox Sparrow, nat. size.

282. **P. ili'aca**. (Lat. *iliaca*, relating to the ilia, or flanks, which are conspicuously marked. Figs. 244, 245.) Eastern Fox Sparrow. ♂, ♀: General color above ferrugineous or rusty-red, purest and brightest on the rump, tail, and wings, on the other upper parts appearing in streaks laid on an ashy ground. Below, white, variously but thickly marked except on the belly and crissum with rusty-red — the markings anteriorly in the form of diffuse confluent blotches, on the breast and sides consisting chiefly of sharp arrow-head spots and pointed streaks. Tips of middle and greater wing-coverts forming two whitish bars. Upper mandible dark, lower mostly yellow; feet pale. One of the finest singers of the family; quite unlike any other Eastern species of sparrow. A large handsome species. Length 6.50–7.25; extent 10.50–11.50; wing 3.25–3.60, averaging 3.40; tail little or not over 3.00, thus decidedly shorter than the wing; bill, along culmen, 0.40; tarsus 0.90; hind claw about 0.35. Sexes alike, and young not particularly different after the first moult, though in an early stage much darker; back rufous-brown with darker streaks; no wing-bars; all the under parts heavily marked. There is much individual variation in color, independently of age, sex, or season. Eastern N. Am.; W. in the U. S. regularly only to the edge of the Plains, occasionally to Colorado; but in Alaska to the Pacific; N. to the Arctic coast. Breeds throughout the interior of British America and in Alaska; not known to do so anywhere in the U. S. Winters from the Middle States southward. Nest on ground or in bushes or trees; eggs pale greenish-white, thickly speckled with rusty-brown, 0.95 × 0.70; general aspect of the egg as in *Zonotrichia* and *Melospiza*.

283. **P. i. unalascen'sis**. (Of the Island of Unalashka.) Townsend's Fox Sparrow. ♂, ♀: General color above dark olive-brown, overcast with a reddish-brown tinge, and the streaking

obsolete, — thus giving a uniform and continuous ruddy-olive tone, becoming more foxy-red on the rump, wings, and tail. Wing-bars obsolete. Beneath, white, thickly marked, excepting on the middle of the belly, with triangular spots of about the same dark color as the back, — aggregated on the breast, and the entire sides of the neck and body almost like the back in uniformity of the color, but still showing ill-defined confluent dark reddish-brown streaks on a more olive-brown ground. Cheeks and auriculars with some whitish speckling. No obvious markings on wings. Bill dusky above, apparently reddish or yellowish below; feet reddish-brown. Size of *iliaca*, but very different-looking in color, and somewhat differently proportioned; wing averaging 3.25, and tail scarcely or not shorter; bill about 0.50; hind claw the same, and as long as its digit. A curious form, related to *iliaca* much as *Melospiza rufina* is to the Eastern song sparrow. Pacific coast region, from Alaska to California, breeding in mountains and northward. (*P. townsendi* Aud. Auct.)

FIG. 245. — Fox Sparrow, reduced. (Sheppard del. Nichols sc.)

284. P. i. schista'cea. (Lat. *schistacea*, slaty; Gr. *σχιστός*, *schistos*, fissile or cleft, as slate-stone is; the allusion, however, is to the color.) SLATE-COLORED FOX SPARROW. ♂, ♀: General color above uniform slate with a slight olive tinge, becoming dull foxy-red on the wings and tail; the streaking of the back obsolete, but whitish wing bars sometimes indicated. Below, white, shaded along the sides with the color of the back, but not so as to obscure the decided markings of the parts; the under parts at large spotted and streaked with dusky-brown, usually aggregated into a blotch on the breast. This is the connecting link between *iliaca* and *unalascensis;* the upper parts are nearly of the slaty-ash that forms the ground color of *iliaca*, only the foxy streaks of the back are obsolete. The spotting below is correspondingly darker. The form has, however, some peculiarities: tail decidedly longer in comparison with the wings. Length about 7.00; wing 3.00–3.25; tail 3.35–3.60; bill 0.45; tarsus 0.90. Rocky Mt. region, chiefly, but noted from Kansas to California.

285. P. i. megarhyn'cha. (Gr. *μέγας*, *megas*, great; *ῥύγχος*, *rhugchos*, *rhynchus*, beak.) LARGE-BILLED FOX SPARROW. Coloration as in *P. schistacea.* Tail at maximum length, averaging at the extreme of that of *schistacea;* claws and beak very highly developed; bill very thick, its depth at base 0.50, rather more than its length from nostril to tip; hind claw longer than its digit. A local race of the last, in the mountains of California and Nevada.

87. CALAMOSPI'ZA. (Gr. *κάλαμος*, *kalamos*, Lat. *calamus*, a reed; *σπίζα*, *spiza*, a finch.) LARK BUNTINGS. Bill large and stout at base, the culmen a little curved, the commissure well angulated; rictus bristly. Wing long and pointed: tip formed by the 1st–4th quills, rest rapidly graduated; inner secondaries enlarged and flowing, one of them about reaching the point of the wing when closed. Tail shorter than wing, nearly even. Feet stout, adapted to terrestrial habits; tarsus about as long as middle toe and claw; lateral toes nearly equal to each other, scarcely reaching the base of the middle claw; hind claw about as long as its digit, but not straightened. A well-marked genus, with wing-structure reminding one of *Anthus* or *Alauda;* the turgid strongly-angulated bill resembles that of a grosbeak. Sexes very dissimilar; ♂ black and white.

286. C. bi'color. (Lat. *bicolor*, two-colored. Fig. 246.) LARK BUNTING. WHITE-WINGED BLACKBIRD. ♂, in summer. Black, with a large white patch on the wings; the quills and tail-feathers frequently marked with white; bill dark horn-blue above, paler below; feet brown. Length 6.00–6.75; extent 10.00–11.00; wing 3.25–3.50; tail 2.50–2.75; bill 0.50–0.55; tarsus, or middle toe and claw, 0.90–1.00. Sexes unlike: ♀ more resembling a sparrow. Above, grayish-brown, streaked with dusky-brown, on the back the edges of the dark streaks often of a purer brown than the general ground-color. Below, white, shaded on the sides with grayish-brown, thickly streaked with blackish-brown everywhere excepting the throat and belly, the streaks mostly sharp and distinct, but blended on the sides, tending to aggregate on the breast, and run forward as a maxillary chain. A poorly-defined light superciliary stripe. Wings dusky, with a large white or whitish speculum, much as in the ♂, but not so pure nor so extensive; inner secondaries edged with brown and white. Tail-feathers, the middle excepted, blackish tipped with white. Young ♂ like the ♀, but colors more suffuse and brighter; upper parts pure brown; under parts tinged with fulvous, the wing-markings quite fulvous; under surface of wing quite blackish. In very young birds the markings more motley than streaky; the bill brownish, flesh-colored below. ♂ wears the black plumage only during the breeding season, like the bobolink; when changing, the characters of the two sexes are confused. In the form of the bill, this interesting species is closely allied to the grosbeaks; and this, with the singularly enlarged secondaries, as long as the primaries in the closed wing, renders it unmistakable in any plumage. A prairie bird, abundant on the central plains; N. to 49° at least, in the Missouri and Milk River region, W. to the Rocky Mts., and southerly to the Pacific. The male has the habit of soaring and singing on wing like a lark; nest on the ground, sunken flush with the surface, of grasses; eggs 4–5, 0.90 × 0.65, pale bluish-green, normally unmarked, occasionally speckled.

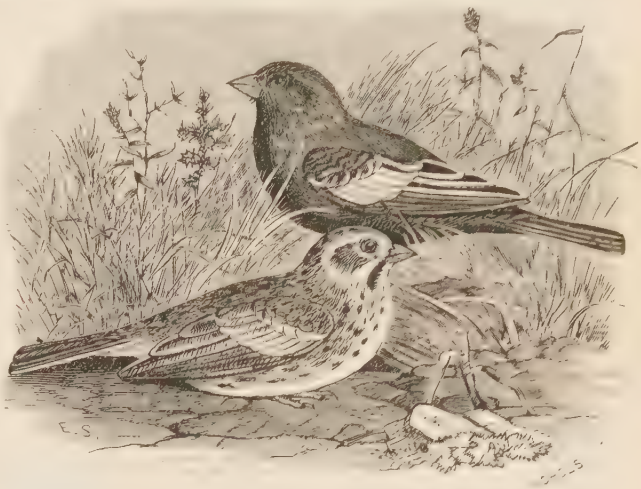


FIG. 246.—Lark Bunting, ♂ ♀, reduced. (Sheppard del. Nichols sc.)

88. SPI'ZA. (Gr. *σπίζα, spiza*, a kind of finch, probably *F. cœlebs.*) SILK BUNTINGS. Bill much as in *Calamospiza*, but longer for its depth and not so strongly angulated. Wings very long and pointed; 2d primary usually longest, 1st and 3d little shorter, 4th and rest rapidly graduated; one inner secondary a little elongated, but not nearly reaching point of wing. Tail short, nearly even, but a little emarginate. Tarsus and middle toe and claw of about equal lengths; lateral toes of nearly equal lengths, not reaching base of middle claw; hind toe with claw as long as the middle toe without claw.

287. S. america'na. (Lat. of America. Fig. 247.) BLACK-THROATED BUNTING. ♂: Above, grayish-brown, the middle of the back streaked with black, the hind neck ashy, becoming on the crown yellowish-olive with black touches. A yellow superciliary line, and maxillary touch of the same; eyelid white; ear-coverts ashy like the cervix; chin white; throat with a large jet-black patch. Under parts in general white, shaded with gray on the sides, extensively tinged with yellow on the breast and belly. Edge of wing yellow; lesser and middle coverts

rich chestnut, other coverts and inner secondaries edged with paler. Bill dark horn-blue; feet brown. Length 6.50–7.00; extent 10.50–11.00; wing 3.25–3.50, sharp-pointed; tail 2.50–2.75, emarginate. ♀. Smaller; wing under 3.00, etc.; above, like the ♂, but head and neck plainer; below, less tinged with yellow, the black throat-patch wanting, replaced by sparse sharp maxillary and pectoral streaks, the wing-coverts not chestnut, though so indicated by rufous edgings of the individual feathers. Young ♂: Larger than the ♀, but in general similar; throat-patch indicated by blackish feathers; wing-coverts chestnut. An elegant species, of trim form, tasteful colors and very smooth plumage, abundant in the fertile portions of the Eastern U. S.; N. to Massachusetts; W. to Kansas, Nebraska, Colorado, and in the south to Arizona; rather southerly, scarcely reaching the N. border of the U. S. anywhere; winters wholly extralimital: breeds throughout its U. S. range. Not a good vocalist: the simple ditty sounds like *chip-chip-chee, chee, chee.* Nest on the ground, or in a low bush.: eggs 4–5, normally plain greenish-white, rarely speckled: .81 × .61.

Fig. 247.—Black-throated Bunting, reduced. (Sheppard del. Nichols sc.)

288. **S. townsendi.** (T. J. K. Townsend.) Townsend's Bunting. "Upper parts, head and neck all round, sides of body and fore part of breast, slate-blue; back and upper surface of wings tinged with yellowish-brown; interscapulars streaked with black; superciliary and maxillary line, chin and throat and central line of under parts from breast to crissum, white; edge of wing, and gloss on breast and middle of belly, yellow; a black spotted line from lower corner of lower mandible down the side of the throat, connecting with a crescent of streaks in the upper edge of the slate portion of the breast." Pennsylvania; one specimen known, a standing puzzle to ornithologists, on the uncertainty whether it is a "good species," or merely an abnormal plumage of the last, or a hybrid, possibly of *S. americana* ♀ × ♂ *Guiraca cærulea.* While it is not improbable that the type came from an egg laid by *S. americana*, even such immediate ancestry would not entitle recognition of "specific characters:" the solitary bird having been killed, it represents a species which died at its birth.

89. **ZAMELO'DIA.** (Gr. ζά, *za*, much, very: μελῳδία, *melodia* melody. Fig. 248.) Song Grosbeaks. Bill extremely heavy, with the lower mandible as deep as the upper or deeper, the commissural angle strong, far in advance of the feathered base of the bill, the rictus overhung with a few long stiff bristles. Wing with outer 4 primaries abruptly longer than 5th. Tail shorter than wing, even or scarcely rounded. Feet short and stout. Embracing two large species, of beautiful and striking colors, the sexes dissimilar. ♂ black and white, with carmine-red or orange-brown: ♀ otherwise, but with lining of wings yellow. Brilliant songsters; nest in trees and bushes: eggs spotted.

Fig. 248.—Bill of *Zamelodia* (Z. ludoviciana, nat. size.) (Ad. nat. del. E. C.)

Analysis of Species.

♂ black and white, with carmine-red on breast and under wings. ♀ with lining of wings saffron-yellow. Eastern . . . . . *ludoviciana* 289

♂ black and white, with orange-brown on breast: ♂ ♀ with lining of wings and belly yellow. Western . . . . . *melanocephala* 290

289. Z. ludovicia'na. (Lat. of Louisiana. Figs. 248, 249, 255.) ROSE-BREASTED SONG GROSBEAK. Adult ♂ with the head and neck all around and most of the upper parts black, the rump, upper tail-coverts and under parts white, the breast and under wing-coverts exquisite carmine or rose-red; wings and tail black, variegated with white; bill white; feet grayish-blue; iris brown. ♀ above, streaked with blackish and olive-brown or flaxen-brown, with median white coronal and superciliary line; below, white, more or less tinged with fulvous and streaked with dusky; *under wing-coverts saffron-yellow;* upper coverts and inner quills with a white spot at end; bill brown. Young ♂ at first resembling the ♀; but the rose color appears with the first full feathering. Two or three years are required to produce the perfect beauty. Sexes of same size. Length 7.75–8.50; extent 12.00–13.00; wing 3.90–4.25; tail 3.25; tarsus 0.90. Eastern U. S. and British Provinces, N. to Labrador and the region of the Saskatchewan; W. in U. S. to the Red River Valley, and edge of the Missouri River plains; winters extralimital; breeds from the Middle States northward. A splendid bird! Few combine such attractions for the eye and ear. Nest in bushes and low trees, chiefly of rootlets and slender fibres; eggs 3–4, 1.00 × 0.75, dull greenish, fully splashed and dotted with dark brown, laid in June.

FIG. 249. — Rose-breasted Grosbeak, reduced. (Sheppard del. Nichols sc.)

290. Z. melanoce'phala. (Gr. *μέλας, μέλανος, melas, melanos*, black; *κεφαλή, kephale*, head. Fig. 250.) BLACK-HEADED SONG GROSBEAK. Adult ♂ with the crown, sides of head, back, wings, and tail black; the back usually varied with whitish or cinnamon-brown, the wings spotted with white on the ends of the coverts, and usually also towards the ends of the quills, and with a large white patch at base of primaries; several lateral tail-feathers with large white spots on inner webs near their ends. Neck all around, rump, and under parts rich orange-brown, changing to bright pure yellow on the belly and under wing-coverts; bill and feet dark grayish-blue. Size of the last. The ♀ and young differ much as in the last species, but may be recognized by the *rich sulphur-yellow* under wing-coverts; the bill is shorter and more tumid, 0.66–0.75 along culmen, 0.60 deep at base. ♀, adult: Under parts like those of the ♂, but paler, though the belly and lining of wings are as pure yellow. Upper parts dark brown with an olive shade, varied with whitish or brownish-white, the head blackish with white or brownish coronal and superciliary stripes. Wings dusky, marked as in the ♂, but the basal white spot on primaries restricted; tail as in

FIG. 250. — Black-headed Grosbeak, reduced. (Sheppard del. Nichols sc.)

♀, but the white spots reduced or obsolete. Bill light-colored below. In the ♂ the tendency is to [illegible] black head, back, tail, and wings, the two former pure and continuous, the [illegible] spotted with white as described: but such faultless full dress is not often seen. This splendid Western representative of the elegant rose-breast is common in suitable [illegible] from the Plains to the Pacific, U. S., wintering in Mexico, breeding throughout its U. S. range. Its habits are the same: its nest and eggs are [illegible]

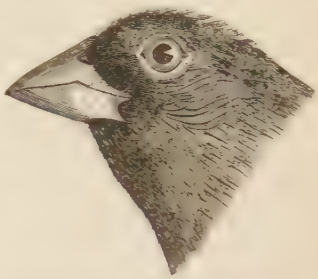


Fig. 251. — Bill of *Guiraca*, nat. size. (Ad nat. del. E. C.)

90. GUIRACA. (Native name, Mex. or S. Am. name of some bird. Fig. 251) BLUE GROSBEAKS. Bill with commissure strongly angulated far beyond base, with deep under mandible and [illegible] as in *Zamelodia*, but not so swollen, the culmen [illegible]. Wings long and pointed, folding about [illegible] tail: tip formed by the 2d–4th quills, 1st little shorter, 5th rapidly graduated. Tail shorter than wings, even. Tarsus rather less than middle toe and claw: outer [illegible] slightly longer than the inner, but scarcely reaching [illegible]. One species, large, ♂ blue, ♀ brown.

291. **G. cærulea.** (Lat. *cærulea*, cerulean. Fig. 252.) BLUE GROSBEAK. Adult ♂: Rich dark blue, nearly uniform, but darker or blackish across middle of back: feathers around base of bill, wings and tail, black: middle and greater wing-coverts tipped with chestnut: bill dark horn-blue, paler below: feet blackish. Length 6.50–7.00: extent 10.50–11.00: wing 3.30–3.60: tail 2.75–3.00: bill 0.60–0.67; tarsus 0.75; middle toe and claw rather more. ♀ smaller, plain warm brown above, paler and rather flaxen-brown below, sometimes whitey-brown on throat and belly, or with slight streaks on belly and crissum: wings and tail fuscous, sometimes slightly bluish-glossed or edged, the former with whitey-brown cross-bars: bill and feet brown. Young ♂ at first like ♀: when changing, shows confused brown and blue: afterward, blue interrupted with white below. U. S., from Atlantic to Pacific, but southerly: rarely N. to Massachusetts, and even Maine: winters wholly extralimital: breeds throughout its U. S. range. Its limit of northward migration with regularity and in any numbers is about the latitude of Philadelphia. Nest in bushes, vines or other shrubbery, [illegible] tree, of grasses and rootlets: eggs 4–5, averaging 0.90 × 0.65, palest [illegible], [illegible] spotted: quite like those of the indigo-bird, but larger.

Fig. 252. — [illegible] Sheppard del Nichols sc.

91. PASSERINA. [illegible], sparrow-like: not well applied to these "matchless ones.", PAINTED FINCHES. Bill relatively smaller and weaker than in the last, with less conspicuous angulation, the culmen regularly a little convex, the gonys nearly straight. Outer 4 primaries longest: 1st usually between 4th and 5th, the latter much shorter. Tail little shorter than wing, about even or emarginate. Feet moderate: tarsus about equal to the middle toe and claw; lateral toes about equal to each other, their claws falling short of base of middle claw. Embracing several elegant finches of small size: the males of very showy hues, especially blue, but also red, purple, yellow, and green, usually in masses; the females of simple and tasteful greenish or brownish shades.

Analysis of Species.

♂ rich blue, intense red and golden-green; ♀ greenish and yellow. Southern . . . . . *ciris* 292
♂ purplish-blue, dusky and reddish. ♀ brown. Southwestern . . . . . *versicolor* 293
♂ lazuli-blue and white, the breast brown; ♀ brown and whitish. Western . . . . . *amœna* 294
♂ indigo-blue; ♀ brown. Eastern . . . . . *cyanea* 295

292. P. ci'ris. (Gr. κείρις, *keiris*, name of a bird into which Scylla, daughter of Nisus, was transformed.) Painted Finch. Painted Bunting. Nonpareil. Pope. ♂, adult: Crown and hind neck and sides of head and neck rich blue; back and scapulars beautiful golden-green; eyelids, rump, and entire under parts intense vermilion-red; wings dusky, glossed with green and reddish; tail dusky reddish. Bill dark horn-color; feet dark brown. Size of *C. amœna;* wing 2.75; tail 2.25, a little emarginate. ♀: Above, plain yellowish-green, nearly uniform, this color glossing the dusky wings and tail; below, yellowish; bill brownish, pale below; thus quite different from the *brown* ♀ ♀ of all the following species. Young ♂ at first like ♀; acquiring the red and blue with every possible gradation between the colors of the two sexes. South Atlantic and Gulf States, abundant; up the coast to Carolina, and in the interior to Illinois; Texas and Mexico. An exquisite little creature of matchless hues, well named the "incomparable"; a fair songster, and a favorite cage-bird in Louisiana. Nest in bushes, hedges and low trees; eggs pearly white, speckled with reddish and purplish browns.

293. P. versi'color. (Lat. *versicolor*, various in color; *verto*, I turn; *color*, color.) Purple Painted Finch. Varied Bunting. Western Nonpareil. Prusiano. ♂, adult: Hind head, throat, and fore breast brownish-red or claret-color, the former sometimes scarlet; hind neck and middle of back similar, but more obscured; fore-part of crown purplish-red; rump and upper tail-coverts purplish-blue; below, from the breast, and the wings and tail, dusky, tinged or glossed with purplish; concealed white in feathers of side of rump; lores and circumrostral feathers black. Bill horn-bluish, paler below, stouter than in the other species, with very convex culmen and concave cutting edge of upper mandible. Feet dark. The versicoloration is difficult to describe; the general aspect is that of a purplish-dusky bird, redder or bluer here and there. Size of the others. ♀ plain brown above, whitey-brown below, like *amœna* and *cyanea;* no whitish wing-bars; no black stripe on gonys; concealed white on sides of rump; bill stout. Lower California and Mexico, N. to U. S. border, especially in the Rio Grande Valley, where common in some localities. (Accidental in Michigan.)

294. P. amœ'na. (Lat. *amœna*, delightful, charming, dressy.) Lazuli Painted Finch. ♂, adult: Head and neck all around, entire upper parts, and lining of wings, rich azure or lapis-lazuli blue, more or less obscured on the middle of the back; the lores black. Below, from the blue neck, chestnut-brown, changing to white on the belly and crissum. A firm white wing-bar across ends of the median coverts, and usually another weaker one across tips of greater coverts. Wings and tail dusky, glossed with blue. Bill and feet bluish-black. Length 5.25–5.50; extent 8.00–8.50; wing 2.75–3.00; tail 2.25–2.50; bill 0.37; tarsus 0.65. ♀, adult: Above, flaxen-brown, nearly uniform, but with slightly darker centres of the feathers, and sometimes a faint bluish gloss. Below, buffy or brownish-white, most colored on the breast, palest on throat and belly. Wings and tail fuscous, with faint bluish edgings usually, crossed with two decided brownish-white bars, — the chief distinction from ♀ *cyanea.* ♂, young: Like the ♀; when changing, patched with brown and blue; when very young, ♂ ♀ somewhat streaky, especially on under parts. Replacing *P. cyanea* from the Plains to the Pacific, common in suitable places; habits, nest, and eggs the same.

295. P. cya'nea. (Lat. *cyanea*, Gr. κυάνεος, *kuaneos*, dark blue. Fig. 253.) Indigo Painted Finch. Indigo-bird. Adult ♂: Indigo-blue, intense and constant on the head, glancing greenish with different lights on other parts; wings and tail blackish, glossed with greenish-blue; feathers around base of bill black; bill dark above, rather paler below, with a curious black stripe along the gonys. ♀: Above, plain warm brown, below whitey-brown, obsoletely streaky on the breast and sides; wing-coverts and inner quills pale-edged, but not whitish;

no whitish wing-bars; upper mandible blackish, lower pale, with the black stripe just mentioned, — this is a pretty constant feature, and will distinguish the species from any of our Eastern little brown birds. Young ♂: Like the ♀, but soon shows blue traces, and afterward is blue with white variegation below. Size of the foregoing. Eastern U. S., N. to Maine and Canada; W. to Kansas, Indian Territory, and Texas; winters wholly extralimital; breeds throughout its N. A. range. Abundant in fields and open woodland, in summer; a well meaning but rather weak vocalist, whose low rambling strain is delivered as if the little performer were tired or indifferent. Nest in the crotch of a bush, large for the size of the bird, and not at all artistic; eggs usually 4–5, averaging 0.72 × 0.52, white with a faint blue shade, and normally plain, though not seldom a little speckled.

Fig. 253. — Indigo-bird, reduced. (Sheppard del. Nichols sc.)

92. SPERMO'PHILA. (Gr. *σπέρμα, sperma*, seed; *φίλος, philos*, loving.) Pygmy Finches. Bill like that of a bullfinch in miniature, short and extremely turgid; swollen in all directions, culmen convex nearly in the sextant of a circle; cutting edge of upper mandible very concave; gonys short, about straight in outline. Wings short and greatly rounded; 2d–4th quills longest, 1st, 5th, and even 6th, little shorter, and secondaries nearly covering primaries in the closed wing. Tail rather shorter than wings, slightly rounded, with abruptly pointed tips of the feathers. Tarsus equal to middle toe and claw, and lateral toes to each other, their claws about reaching base of middle claw. A large C. and S. Am. genus of pygmy finches, one of which reaches our border; our most diminutive fringilline (but *Phonipara* is about the same).

296. S. morelet'i. (To one Morelet.) Morelet's Pygmy Finch. Little Seed-eater. ♂: Top and sides of head, back of neck, broad band across upper part of breast, middle of back, wings, and tail, black; chin, upper throat, neck nearly all around, rump, and remaining under parts, white, the latter often tinged with pale buff; two wing-bands, and bases of all the quills, also white, that on the secondaries hidden by the coverts, that on the primaries forming an exposed spot; inner secondaries usually edged with white; tail-feathers sometimes with obscurely whitish tip. Bill blue-black; feet dark. ♀ olivaceous-brown above, brownish-yellow or dull buff below; wings with whitish bars, but no white bases of quills; bill brown; feet dark. Length about 4.00; wing 2.00–2.10; tail 1.90; tarsus 0.60. Mexico to Texas, in the Lower Rio Grande valley.

93. PHONI'PARA. (Gr. *φωνή, phone*, sound, voice; Lat. *pario*, I produce: badly formed.) Grass Quits. Bill small, acute, culmen slightly convex, commissure about straight to the angulation at base. Wings short, rounded, 2d–5th primaries subequal and little longer than 1st, 6th, 7th. Tail still shorter, about even. Tarsus if anything shorter than middle toe and claw; lateral toes subequal to each other in length, scarcely reaching base of middle toe. A West Indian genus of diminutive finches, one of which occurs in Florida.

297. P. ze'na. (*Vox barb.*; perhaps proper name.) Black-faced Grass Quit. ♂, adult: Upper parts, including exposed surfaces of wings and tail, dull olivaceous, passing on the face, throat, and breast, into sooty-black, fading on other under parts into olive-gray, more or less varied with whitish; wings and tail unmarked; no decided demarcation of colors anywhere. Bill blue-black; feet dark brown. ♀ lighter olivaceous, passing to olive-ashy where the ♂ is black; bill pale below; feet light brown. Length about 4.00; wing 2.00–2.10; tail 1.75. West Indies and Florida. One of the common house finches in various West Indian Islands;

nest in bushes and shrubbery, large, domed, with lateral entrance; eggs 3–6, 0.65 × 0.50, white, speckled with reddish.

94. **PYRRHULO'XIA**. (Lat. *pyrrhula* + *loxia; pyrrhula*, a bullfinch; *loxia*, a cross-bill. Gr. πυῤῥός, *purhros*, red; λοξίας, *loxias*, crooked.) Bullfinch Cardinals. Bill very short and stout, hooked almost like a parrot's: its depth at base exceeding its length; under mandible deeper than upper at nostrils; culmen curved almost to the quadrant of a circle; commissure forcibly angulated in advance of nostrils; gonys about straight. Otherwise generally like *Cardinalis*. Colors grayish and red; head crested. One large species.

298. **P. sinua'ta**. (Lat. *sinuata*, bent, bowed, curved; *sinus*, a bend, bay: alluding to the bill.) Bullfinch Cardinal. Texas Cardinal. Conspicuously crested, and otherwise like the common cardinal in form, but the bill extremely short and crooked. ♂: Ashy-brown, paler or whitish below; the crest, face, throat, breast, and middle line of belly, with the wings and tail, more or less perfectly crimson or carmine red; bill whitish. Length 8.00–8.50; extent 11.00–12.00; wing 3.50–4.00; tail 3.75–4.25. ♀ similar to the ♂, more so than ♀ *Cardinalis*: red of crest, wings, and tail much the same; rather brownish-yellow below, usually with traces of red on the breast and belly, sometimes without. Young ♂ like the ♀. At an early age, both sexes have the bill obscured. In this species the crest is long, but thin, consisting of a few coronal feathers, without general elongation of the head-plumage. The shade of red is very variable in equally adult males. In highest feather it is continuous on the under parts from bill to tail along the median line; but it is often broken into patches on throat, belly, and crissum. The tint is always carmine, not vermilion as usual in the common cardinal. The intense rose-color is well displayed on spreading the wings. A singular bird, inhabiting the U. S. near the Mexican border, from Texas to Lower California; abundant in the valley of the Lower Rio Grande. The habits, nest, and eggs are substantially the same as those of the common cardinal.

95. **CARDINA'LIS**. (Lat. *cardinalis*, pertaining to *cardo*, a door-hinge; *cardinal*, that upon which something hinges or depends; hence important, principal, *cardinal* point; *cardinal*, a chief ecclesiastical official, wearing the red hat; hence *cardinal-red*, from which color the bird is named. Fig. 254.) Cardinal Grosbeaks. Bill very large and stout, but quite conic; culmen a little convex; gonys about straight; commissure sinuate, not abruptly angulated; lower mandible about as deep as upper; rictus bristled. Wings very short and rounded; usually 4th and 5th quills longest, others rapidly graduated both ways, — 5th to 1st, 5th to 9th. Tail longer than wings, rounded, of broad feathers with obliquely oval tips. Tarsus longer than middle toe and claw; lateral toes subequal. Size large. Head crested. Color mostly red, including bill. Sexes subsimilar.

Fig. 254. — Head of Cardinal Grosbeak, nat. size. (Ad nat. del. E. C.)

299. **C. virginia'nus**. (Of Virginia; name inappropriate to Queen Elizabeth. Figs. 254, 255.) Cardinal Grosbeak. Cardinal Red-bird. Virginia Nightingale. ♂, adult: Rich red, usually vermilion, sometimes rosy; pure and intense on crest and under parts, darker on back, where obscured with ashy-gray, as it is also on upper surfaces of wings and tail; the feathers of the wings fuscous on inner webs. A jet-black mask on the face, entirely surrounding the bill, extending on the throat. Bill coral-red; feet brown. Length 8.00–9.00; extent 11.00–12.00; wing 3.50–4.00; tail 4.25–4.75; bill 0.67–0.75; tarsus 0.90–1.00. ♀ rather less: Ashy-brown, paler and somewhat yellowish-brown below, with traces of red; reddening much as in the ♂ on crest, wings, and tail. Young ♂: At first like ♀, but soon reddening; at an

early age, bill dark. Eastern U. S., southerly, seldom N. to the Connecticut Valley; along the Mexican border shading into *C. v. igneus*. A bird of striking appearance and brilliant vocal powers, resident and abundant from the Middle States southward; inhabits thickets, tangle and undergrowth of all kinds, whence issue its rich rolling whistling notes while the performer, brightly clad as he is, often eludes observation by his shyness, vigilance, and activity. The nest, built loosely of bark-strips, twigs, leaves, and grasses, is placed in a bush, vine, or low

FIG. 255. — Cardinal Grosbeak, upper; Rose-breasted Grosbeak, lower: reduced. (From Brehm.)

thick tree: the eggs are 1.00–1.10 long, 0.70–0.80 in breadth, profusely marked with browns, from reddish to dark chocolate, with neutral tint in the shell, usually in fine dotting or marbling pattern. Two or three broods are reared in the South. Like the rose-breasted grosbeak, the cardinal is a favorite cage-bird.

300. C. v. ig'neus. (Lat. *igneus*, fiery.) FIERY-RED CARDINAL. Like the last; not redder, but if anything lighter red; black mask narrowed on forehead, or so interrupted there that the red reaches to the bill; crest inclining to light red, more like that of belly than of back. Bill

tending to swell, with more decidedly curved culmen. Tail rather longer, on an average. Valley of the Colorado and Gila, and Lower California, common.

96. **PI'PILO.** (Lat. *pipilo* or *pipio*, I pip, peep, chirp.) TOWHEE BUNTINGS. Embracing numerous species and varieties of large *Fringillidæ*, varying much in system of coloration and details of form, and therefore not easy to characterize concisely. Excepting one species, *all are over seven inches long.* Bill moderate in size, conic without extremes of turgidity or compression, but varying much in precise shape with the species. Feet large and strong, fitted for ground work; tarsus about equalling or rather exceeding the middle toe and claw; lateral toes subequal, outer usually a little the longer, its claw reaching, in some cases exceeding the base of the middle claw; the claws all stout and much curved, in some species highly developed. Wings short and greatly rounded, about the 4th–5th primary longest, whence the quills are rapidly graduated to 1st and 9th; 1st very short. Tail long, exceeding the wings, rounded or much graduated, of broad firm feathers with rounded ends. Large species, inhabiting shrubbery, and partly terrestrial. They fall in 3 sections or series. I. *Black Towhees:* of which the only Eastern species is a typical example. In this, the sexes are very unlike, but the difference is less in the Western varieties into which it runs: all the forms are black on head and upper parts, with black, white-marked wings or tail, the back also white-marked or not; belly white, sides chestnut. II. *Brown Towhees:* variously brown above, paler, etc., below, the sexes alike. These are confined to the Southwest, where the numerous species stand in the same relation to *Fringillidæ* that the Southwestern forms of *Harporhynchus* bear to *Turdidæ*. III. *Green Towhees:* one small species, standing alone.

OBS. I. The black series of *Pipilo* offers a case nearly parallel with those of *Melospiza*, *Passerella* and *Junco* already discussed. There is one Eastern form much more distinct from the several Western ones than these are from one another. It is uniform black above, seldom with a trace of white spotting on the scapulars: the ♀ distinctively brown where the ♂ is black. The Western ones all have spotted scapulars and sometimes also interscapulars; and ♀ ♀ are blackish, much like the ♂ ♂. (These furthermore shade into an *olivaceous* Mexican form.) *P. arcticus* corresponds in a way with *Melospiza heermanni*, *Passerella schistacea*, and *Junco caniceps*; *P. oregonus* with *Melospiza guttata* or *rufina*, *Passerella unalascæ* and *Junco oregonus*; *P. megalonyx* exactly with *Passerella megarhyncha*. It might be more consistent to treat all the black Towhees as races of one incompletely specified stock; but it is not easy to so far ignore the sexual distinctiveness, nor the fact that though *P. erythrophthalmus* has occasional spots on the scapulars, its intergradation is scarcely established. II. The Brown Towhees afford one remarkably distinct species, *P. aberti*, to be likened to *Harporhynchus crissalis;* and others incompletely separated from each other, like *H. redivivus* and *H. lecontii*.

Analysis of Species and Varieties.

1. *Black Towhees.* Colors of the male black, white, and chestnut in definite areas.
   - No white on the scapulars or wing-coverts. Sexes very unlike.
     - Eyes red in the breeding season. Eastern U. S. at large . . . . . *erythrophthalmus* 301
     - Eyes white in the breeding season. Florida, resident . . . . . *alleni* 302
   - Scapulars and wing-coverts with white spots; sexes more alike. Western.
     - Little if any white at bases of primaries; none on outer web of outer tail-feathers except at end. *oregonus* 303
     - White on wings and tail as in *erythrophthalmus*, but interscapulars streaked . . . . *arcticus* 304
     - Like the last; claws highly developed; sexes nearly alike . . . . . *megalonyx* 305
2. *Brown Towhees.* Colors not definitely black, white and chestnut; no greenish; sexes alike. Southwestern.
   - Grayish-brown, paler below, without blackish face; throat and crissum fulvous or rufescent.
     - Light; belly whitening; crissum yellowish-brown; necklace of dusky streaks . . . *mesoleucus* 306
     - Similar; more white on throat . . . . . *albigula* 307
     - Dark; belly only paler; crissum cinnamon-brown; throat fulvous, speckled . . . . . *crissalis* 308
   - Grayish-brown, paler below; face blackish; no other decided markings . . . . . *aberti* 309
3. *Green Towhees.* Colors greenish; sexes alike.
   - Crown brown, throat white, breast ashy, edge of wing yellow, etc. . . . . *chlorurus* 310

301. P. erythrophthal'mus. (Gr. ἐρυθρός, *eruthros*, red: ὀφθαλμός, *ophthalmos*, eye.) TOWHEE BUNTING. MARSH ROBIN. CHEWINK. ♂, adult: Glossy black; belly white; sides chestnut; crissum fulvous-brown; primaries and inner secondaries with white touches on the outer webs; outer tail-feather with outer web and nearly the terminal half of inner web white, the next two or three with white spots decreasing in size; bill black; feet pale brown; iris red in the adult, white or creamy in the young, and generally in winter specimens. Normally, the black pure and continuous; occasionally, white touches on wing-coverts and scapulars. White on primaries confined to bases of outer 6, and their outer webs at about their middle; on secondaries to outer webs of inner 2 or 3. Black feathers of throat with concealed whitish bases. Length 7.50–8.75; extent 10.00–12.00; wing 3.20–3.90; tail 3.35–4.00; tarsus 1.00–1.12; but these extremes are rare; average length 8.00; extent 11.25; wing 3.75; tail 4.50. ♀: Rich warm brown where the male is black; otherwise similar, but smaller. *Very young* birds are streaked brown and dusky above, below whitish tinged with brown and streaked with dusky; but this plumage is of brief duration; sexual distinctions may be noted in birds just from the nest, and they rapidly become much like the adults. Eastern U. S. and British Provinces; N. to Canada, Minnesota and Dakota, where meeting *P. arcticus;* W. to Kansas, and in Missouri River region to about 43°. Northerly perfectly migratory; winters from middle U. S. southward; breeds nearly throughout its range. An abundant and familiar inhabitant of thickets, undergrowth, and briery tracts, spending much of its time on the ground, scratching among fallen leaves. Nest on the ground, bulky, of leaves, grasses and other fibrous material; eggs 4–5, 0.95 × 0.70, white, thickly speckled with reddish. The curious names "Towhee" and "Chewink" are from its cry; "Marsh Robin" from its haunts and the chestnut of the sides.

302. P. e. al'leni. (To J. A. Allen, the eminent naturalist.) WHITE-EYED TOWHEE BUNTING. Similar; smaller; less white on the wings and tail; claws longer; *iris white.* ♂, extremes: Length 7.25–8.50; extent 9.50–11.55; wing 2.80–3.50; tail 3.25–4.00; tarsus 0.80–1.10; average length 7.90; extent 9.90; wing 3.12; tail 3.50; tail *relatively* longer than in Northern specimens, producing less difference in total length than there is in length and extent of wings. White on outer tail-feather about as much as on the next feather of *P. erythrophthalmus.* Florida; resident; a local race.

[**P. macula'tus.** (Lat. *maculatus*, spotted.) OLIVE-BLACK SPOTTED TOWHEE. A Mexican species, with extensively olivaceous coloration and streaked back, into which the following three varieties shade imperceptibly, — *oregonus* being farthest removed and most like *erythrophthalmus, arcticus* and *megalonyx* successively nearing the Mexican stock-form.]

303. P. m. ore'gonus. (To the Territory of the Oregon.) OREGON TOWHEE. ♂: Very similar to *erythrophthalmus;* quite as black, but not continuously so; wing-coverts with small rounded, and scapulars with larger oval, white spots on the outer webs of the feathers near the end; interscapulars sometimes also with white touches; white marks on the primaries and inner secondaries very small or wanting, usually none at the bases of the former; white spots on tail-feathers very small, the outer web of the outer rectrix not white except at the end. Excepting these particulars, this form looks more like *erythrophthalmus* than like the typical *maculatus,* in which the body-colors are *olivaceous.* ♀ dark umber-brown, but not quite blackish. Pacific coast region, N. to British Columbia, S. to Southern California, melting eastward into *arcticus,* southeastward into *megalonyx.*

304. P. m. arc'ticus. (Lat. *arcticus*, arctic.) ARCTIC TOWHEE. Similar to the foregoing; less purely and continuously black, with tendency to olivaceous on back and rump; white spots of wing-coverts larger, those of scapulars still larger and lengthening into streaks; interscapulars also streaked with white; white on the quills and tail-feathers at a maximum, as in *erythrophthalmus;* usually, also, concealed white specks in the black of the throat. ♀ comparatively dark, but not quite blackish. In this form, the white on the wing-quills and tail-feathers, so much reduced in the glossy black *oregonus*, is as extensive as in *erythrophthalmus;* but the

wing-coverts, scapulars and interscapulars are fully marked with white; the black tends to olive, at least on rump, and the ♀ is not fairly brown. Central region of N. Am., from the limit of *erythrophthalmus* in Kansas, Nebraska, and Dakota, to that of *oregonus* in Oregon and Washington; in the S. Rocky Mt. region melting into *megalonyx*.

305. P. m. megalo'nyx. (*μεγάλη, megale*, great; *ὄνυξ, onux*, claw.) SPURRED TOWHEE BUNTING. The prevailing form in the S. Rocky Mt. region, New Mexico, Arizona and California. Precisely like *arcticus*, but feet larger, with highly-developed claws; hind claw decidedly longer than its digit; lateral claws reaching to or beyond middle of middle claw. In this form at any rate, the ♀ is hardly distinguishable in color from the ♂, being slaty-blackish with an appreciable olivaceous shade, thus exhibiting a decided approach to the typical Mexican stock. The note is entirely different from that of the Eastern Towhee, being so exactly like the scolding "mew" of a cat-bird, that I have heard persons stoutly contend that there are cat-birds in Arizona. The general habits, nest and eggs of all these Western Towhees are substantially the same as those of the Eastern.

[**P. fus'cus.** (Lat. *fuscus*, dark brown.) MEXICAN BROWN TOWHEE. An obscure Mexican stock form, carelessly described by Swainson, to which the three following N. Am. birds are probably referable as varieties.]

306. P. f. mesoleu'cus. (Gr. *μέσος, mesos*, middle; *λευκός, leucos*, white; the middle under parts whiter than in *crissalis*.) BROWN TOWHEE. CAÑON TOWHEE. ♂, ♀: Above, uniform grayish-brown with a slight olivaceous shade; crown brown in appreciable contrast; wings and tail like the back, unmarked, or some tail-feathers with rusty tips. Below, a paler shade of the color of the back, whitening on the belly, tinged with fulvous and streaked with dusky on the sides of throat and middle of breast, washed with rich rusty-brown on the flanks and crissum. The belly is usually quite white, contrasting with the rusty flanks and vent; the throat is ochrey, usually immaculate and embraced necklace-wise with dusky spots in series on each side, aggregated and blotched on the breast. Bill dusky, paler below; feet brown, toes usually darker than tarsus. Sexes indistinguishable. In fresh fall specimens, the tawny suffuses nearly all the under parts except middle of belly, and the throat spots are diffused instead of being in series. In the very early streaked stage, there is no distinction of a brown cap; the wing-coverts are rusty-edged; and the whole under parts are dusky-streaked. Length 8.00–8.50; wing 3.60–4.00; tail 4.25–4.60. S. W. U. S., chiefly New Mexico and Arizona, but also W. Texas, S. Colorado, Utah and Nevada, and interior of Southern California. Nest in bushes; eggs, as in all the Brown Towhees, specked and scratched with blackish on a pale greenish ground. (*P. fuscus* of the Key, orig. ed.)

307. P. f. albi'gula. (Lat. *albus*, white; *gula*, throat.) WHITE-THROATED BROWN TOWHEE. Exactly like the last, but the white of the under parts extending further up the breast, the gular spots more restricted, sparser, and better defined. Lower California. Slightly distinguished; but in good spring specimens the rusty is restricted to the crissum; the ochraceous of the throat is less extensive, paler, and mainly confined within the necklace.

30 . P. f. crissa'lis. (Low Lat. *crissalis*, relating to the *crissum*, the under tail-coverts, which are highly colored.) CRISSAL TOWHEE BUNTING. CALIFORNIA TOWHEE. Similar to *mesoleucus;* crown like the back; rather darker above, with an olivaceous tinge, decidedly so below, the middle of the belly scarcely or not whitening, the gular fulvous strong, and, with its dusky streaks, definitely restricted to the throat; the flanks and crissum chestnut or deep cinnamon-brown. Rather larger: wing 4.00; tail 5.00; ♀ rather less. Coast region of California (and northward?), abundant. Nest in bushes, probably also on ground; eggs 3–4, 0.95 × 0.72, pale greenish or bluish-white, fully spotted with blackish and neutral tints. This is the dark coast form, bearing the same relation to *mesoleucus* that the coast *Harporhynchus redivivus* bears to the paler *H. lecontii* of the interior. The crown is brownish, but not forming a cap contrasting with the back; the throat is fulvous rather than ochrey; this color of very limited

extent, and speckled with dusky throughout; the crissum rich rusty. (It is the *P. fuscus*, Cass., Ill., 1854, pl. 17; Bd., 1858; but not the true *fuscus* of Sw.; *Fringilla crissalis*, Vigors, 1839.)

309. P. a'berti. (To Lieut. J. W. Abert.) ABERT'S TOWHEE. GRAY TOWHEE. Somewhat similar to the foregoing species of this section of the genus, but entirely distinct; a very large, long-tailed form, with no decided markings anywhere excepting the dark face. Above, grayish-brown, with a slight fulvous tinge; wings and tail darker and purer brown, the tail-feathers slightly rusty-tipped. Below as above, but paler, by dilution with a peculiar pale pinkish-brown shade (like that on the side of an Oregon snow-bird), particularly on the throat; crissum more cinnamon-brown; lores and chin blackish. Bill and feet brown; under mandible paler than the upper. Young more rusty. There is much individual variation in shade, but this large dingy whole-colored bird with dark face is always easily recognized. Length about 9.00; wing 3.40–3.70; tail 4.50–5.00; tarsus 1.00–1.10. New Mexico and Arizona, abundant, especially in the valley of the Gila and Colorado, where we find it a wild and shy inhabitant of thickets and chaparral; N. to Colorado and Utah. Nest in bushes, loose and bulky; eggs 3–4, 1.00 × 0.75, bluish-white, sparingly speckled and scrawled with blackish.

310. P. chloru'rus. (Gr. *χλωρός, chloros*, green; *οὐρα, oura*, tail.) GREEN-TAILED TOWHEE. BLANDING'S FINCH. ♂, ♀, adult: Above, grayish-green, sometimes quite olive-gray, at others bright olive-green, the exposed surfaces of the wings and tail with brighter greenish edgings. Edge of wing and under coverts and axillaries bright yellow. Crown rich chestnut; forehead blackish, with a whitish loral spot on each side. Chin and throat pure white, bounded by dusky maxillary stripes as sharply contrasted as in the white-throated sparrow with dark surroundings. Whole breast and sides of head, neck and body fine clear ash, or slate-gray, obscured on the flanks and crissum with brownish, fading to white on the belly; completing the resemblance to *Zonotrichia albicollis*. Bill blackish-plumbeous; feet brown, toes darker. Length about 7.00; extent 9.50; wing 2.80–3.20; tail 3.40–3.70; tarsus 0.95. Less mature birds have the chestnut cap veiled by gray tips of the feathers. *Young:* Crown like back. Upper parts dull brown tinged with greenish in places, streaked throughout with dusky, but wings and tail as in the adult; under parts forecasting the pattern of the adults, but dusky-streaked throughout. This stage is brief and the birds resemble the adults after the first fall moult. An interesting bird, of no intimate relations with any other; it has long been conventionally placed in *Pipilo*, for want of a better location; it is not easy to see how it differs in form from *Zonotrichia* or *Embernagra*. Southwestern U. S., especially S. Rocky Mts.; N. to Wyoming and Idaho; migratory; winters over our border. A sprightly inhabitant of shrubbery; nest in bush or on the ground; eggs 0.90 × 0.68, pale greenish or grayish-white, freckled all over with bright reddish-brown, usually aggregating or wreathing at the larger end.

97. EMBERNA'GRA. (A villanous compound of *emberiza*, a bunting, and *tanagra*, a tanager; the former is only Latinized from Old German, the latter is South American.) The integrity of the genus is questionable. Said to contain several extralimital species not nearly allied to ours. It is difficult to see how the following species differs more than specifically from *Pipilo chlorurus*. It offers the following details of form: Bill not notable in any way. Tarsus exceeding the middle toe and claw. Lateral toes short; outer a little longer than inner; claw of neither reaching base of middle claw; fore claws all small and weak; hind claw about as long as its digit. Wings very short and much rounded; 4th to 7th primaries about equal and longest; 2d as long as 9th; 1st equalling the 3d from the innermost secondary. Tail about as long as the wings, much rounded, the outer feathers half an inch shorter than the middle ones; all broad to their rounded ends. Coloration olivaceous with yellow edge of wing and inconspicuous head-stripes.

311. E. rufovirga'ta. (Lat. *rufo*, with rufous, *virgata*, striped; *virga*, a rod.) GREEN FINCH. TEXAS SPARROW. ♂, adult: Above, dull olive-green, brighter on wings and tail. Under

parts shading from color of the upper through grayish-olive and olive-gray to sordid whitish, purest on the middle of the belly. Inner webs of wing-quills fuscous; tail the same, but more glossed with greenish, and sometimes showing traces of crosswise watering with darker waves, as often seen in the song sparrow. Whole bend and lining of wing bright clear yellow. Crown like back, with two broad stripes of dull rufous from nostrils to nape; a similar rufous stripe behind eye, sometimes traceable past eye to the lore, then defining a superciliary line of light olive-gray or whitish. A whitish eye-ring. Upper mandible light brown, lower drying yellowish; feet pale. Length 6.25–6.75 (not 5.50, as in Baird); extent 8.50–9.00; wing 2.40–2.75; tail the same; bill 0.50; tarsus 0.90; middle toe and claw 0.75. ♀ said to differ immaterially, and young to lack the head-stripes. Young, first plumage: Above, mixed brown and olive-tawny; wings brown, edged with olive, the coverts edged and tipped with tawny; breast like back; belly tawny. Texas, in Lower Rio Grande Valley. Inhabits shrubbery, chaparral, and close cover of all kinds, where it is difficult to discover, owing to its quiet ways and greenish tints. Keeps near the ground, but builds a domed nest of twigs and grasses in bushes and low trees; two broods are reared in May–June, and Aug.–Sept. Eggs 2–4, pure white, unmarked, averaging 0.85 × 0.65, but from 0.75–0.90 by 0.60–0.70.

17. Family ICTERIDÆ: American Starlings: Blackbirds, etc.

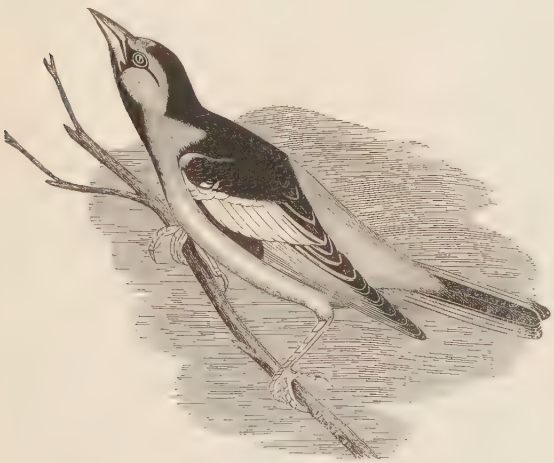


FIG. 256. — A typical *Icterus* (*I. bullocki*). (After Audubon).

Cultrirostral Oscines with 9 *primaries.* — A family of moderate extent, confined to America, where it represents the *Sturnidæ*, or Starlings of the Old World. It consists of the Blackbirds and Orioles, among the former being included the Bobolinks, Cow-birds, and Meadow "Larks." It is nominally composed of 150 species, half of which may prove valid, distributed among 50 genera or subgenera, of which one-fourth may be considered worthy of retention. The relationships are very close with the *Fringillidæ*, on the one hand; on the other, they grade toward the Crows (*Corvidæ*). They share with Fringilline birds the characters of angulated commissure and 9 developed primaries, and this distinguishes them from all the other families whatsoever; but the distinctions from the *Fringillidæ* are not easily expressed. In fact, I know of no character that will relegate the Bobolink and Cowbird to the *Icteridæ* rather than to the *Fringillidæ*, in the current acceptation of these terms. In general, however, the *Icteridæ* are *cultrirostral* rather than strictly *conirostral* Oscines, having that cutting rather than crushing style of bill seen in perfection in the crows, toward which some of the *Icteridæ* approach; being thus distinguished by the length, acuteness, and not strictly conical shape of the unnotched, unbristled bill, which has a peculiar extension of the culmen on the forehead dividing the prominent antiæ of close-set velvety feathers that reach to or on the nasal scale — a character well exhibited in *Sturnella*, for instance. In length, the bill *usually* equals if it does not exceed the head; the tip is unnotched, the rictus unbristled, the commissure obtusely but evidently angulated. The bill is shortest and most fringilline in *Dolichonyx* and *Molothrus*; most acute in the Orioles (*Icterus*), where it is sometimes actually decurved; most crow-like in the

Grackles (*Quiscalus*). (See any figs., beyond.) Excepting the arboreal orioles, the feet are large and strong, fitted for the more or less terrestrial life which all the species lead, walking on the ground with ease instead of hopping like most *Fringillidæ*. No specialties of wing or tail; former usually pointed, latter rounded, sometimes very large and fan-shaped.

Among our moderate number of species are representatives of four of the subfamilies into which the *Icteridæ* are conveniently and quite naturally divisible. In most of the genera black is the prevailing color, — either uniform and of intense metallic lustre, or contrasted with masses of red or yellow. In *Sturnella* alone the pattern is "niggled." In nearly all, the sexes are conspicuously dissimilar, the female being smaller and brownish or streaky in the iridescent black species, greenish and yellowish in the brilliantly colored ones. All are migratory in this country. Other details are best given under heads of the subfamilies. These groups, with their component genera, may be analyzed as follows by the salient features more likely to attract the attention of the student than less obvious technical characters: —

Analysis of Subfamilies and Genera

AGELÆINÆ. *Marsh Blackbirds.* Terrestrial and gregarious. Bill conic-acute, sometimes quite fringilline, shorter or scarcely longer than head. Feet stout.

Bobolinks. Sexes unlike in summer. Black and buff, or yellowish, no red. Tail-feathers very acute. Tarsus shorter than middle toe and claw . . . . . *Dolichonyx* 98

Cowbirds. Sexes unlike. Lustrous black ♂, brown ♀; no red or yellow . . . . . *Molothrus* 99

Blackbirds. Sexes unlike. Lustrous black ♂, red on wing; streaky ♀; no yellow . . . *Agelæus* 100

Blackbirds. Sexes unlike. Lustrous black ♂, brown ♀, both with yellow head . *Xanthocephalus* 101

STURNELLINÆ. *Meadow Larks.* Terrestrial and imperfectly gregarious. Bill of peculiar shape. Tail very short. Feet large and stout.

Sexes alike. Motley-colored, extensively yellow below . . . . . *Sturnella* 102

ICTERINÆ. *Orioles.* Arboreal, non-gregarious. Bill extremely acute, sometimes decurved. Feet weak. Sexes unlike.

Black, with yellow or orange or chestnut in masses, in the ♂; ♀ greenish and yellowish . . *Icterus* 103

QUISCALINÆ. *Crow Blackbirds.* Terrestrial and gregarious. Bill elongate, corvine. Feet stout. Color of ♂ entirely iridescent black; ♀ brown or blackish.

Bill shorter than head; even tail shorter than wings . . . . . *Scolecophagus* 104

Bill not shorter than head; graduated tail not shorter than wings . . . . . *Quiscalus* 105

22. Subfamily AGELÆINÆ: Marsh Blackbirds.

Gregarious, granivorous species, more or less completely terrestrial, and chiefly palustrine, not ordinarily conspicuous vocalists; building rather rude, not pensile, nests, laying 4–6 spotted or curiously limned eggs. With the feet strong, fitted both for walking and for grasping swaying reeds; the wings more or less pointed, equalling or exceeding the tail in length; the bill conic-acute, shorter or little longer than the head, its cutting edges more or less inflected. Four well-marked genera, the species of which abound in the United States, on plain and prairie, in marsh and meadow. In the West, they swarm about the settlements, stage stations, military posts and other detestable places.

98. **DOLICHONYX.** (Gr. δολιχός, *dolichos*, long; ὄνυξ, *onux*, claw.) BOBOLINKS. Sexes unlike, but only in the breeding season: ♂ black, buff and white; ♀ brownish and yellowish. Bill short, conic, fringilline, not nearly as long as head. Wings long and pointed, 1st and 2d quills longest, others rapidly graduated. Tail stiffened, with rigid very acute feathers, almost like a woodpecker's, shorter than wing. Feet stout; tarsus shorter than middle toe and claw; claws all very large. One remarkable species, though there are several others in tropical America; noted for the peculiar changes of plumage and the "mad music" of the ♂; abundant in marsh and meadow of the Eastern U. S.

312. **D. oryzi'vorus.** (Gr. ὄρυζα, *oruza*, Lat. *oryza*, rice; *voro*, I devour. Fig. 257.) BOBOLINK. MEADOW-WINK. SKUNK BLACKBIRD, Northern States. REED-BIRD, Middle States. RICE-BIRD, Southern States. ♂, in breeding plumage: Black; cervix buff; scapulars, rump and upper tail-coverts ashy-white; interscapulars streaked with black, buff, and ashy; outer quills

edged with yellowish; bill blackish-horn; feet brown. The faultless full dress of black, white, and buff is worn only for a brief period; and even in spring and summer, most males are found to have yellowish touches in the black, especially of the under parts. The "delirious song" is only heard while the males are trooping their way to their breeding-grounds, and before the midsummer change of feather. ♂ in fall, ♀, and young, entirely different in color: Yellowish-brown above, brownish-yellow below; crown and back conspicuously, nape, rump, and sides less broadly, streaked with black; crown with a median and lateral light stripe; wings and tail blackish, pale-edged; bill brown, paler below. In this, the ordinary condition, the ♂ is only known by superior size. Fall birds are more buffy than the spring ♀. The ♂ changing shows confused characters of both sexes (see p. 89); but in any plumage the species may be recognized by the stiffish, extremely acute tail-feathers, in connection with its special dimensions. ♂: Length 7.00–7.50; extent 11.50–12.25; wing 3.50–3.80; tail 2.75–3.00; tarsus 1.00; middle toe and claw 1.25. ♀: Length 6.50–7.00; extent 10.50-11.25; wing 3.25–3.50, etc., averaging ½ an inch less in length and an inch in extent. Chiefly Eastern U. S. and Canada; N. to 54° in the region of the Saskatchewan, W. not ordinarily beyond the central plains, but occurs in Montana, Idaho, Utah, and Nevada. Winters wholly extralimital. In May, the vivacious, voluble, and eccentric "Bobolinks" pass North, spreading over the meadows of the Middle and Northern States from the Atlantic to Kansas and Dakota, perfecting its black dress, and breeding in June and July. After the midsummer change the "Reed-bird" or "Rice-bird" comes back, thronging the marshes in immense flocks with the Blackbirds; has simply a chirping note, feeds on the wild oats and wild rice, and becomes extremely fat and is accounted a great delicacy. The name "ortolan," applied by some gunners and restaurateurs to this bird, as well as to the Carolina Rail (*Porzana carolina*) is in either case a strange misnomer, the Ortolan being a fringilline bird of Europe, *Emberiza hortulana* L. (Lat. *hortulanus*, relating to a garden.) In the West Indies, where this bird retires in winter, as it does also to Central and South America, it is called "butter-bird." The names "bobolink" and "meadow-wink" are in imitation of its cry; "skunk blackbird" notes the resemblance in color to the obnoxious quadruped. The migrations are performed mostly at night, when in May and early September one may hear the mellow metallic "chink" of the invisible passengers. Nest on the ground, artfully concealed in the grass; eggs 4–6, 0.90 × 0.65, stone-gray, dotted, mottled, and clouded with dark browns.

FIG. 257. — Bobolink, ♂, reduced. (Sheppard del. Nichols sc.)

99. **MOLO'THRUS.** (Gr. *μολοθρός*, or *μολοβρός*, vagabond, tramp, parasite.) COWBIRDS. Bill short, stout, conic and fringilline, about ⅔ as long as head; but entirely unnotched and unbristled, with little bent of commissure, the broad culmen running well up on the forehead, the nostrils well in advance of the feathers. Wings long and pointed, the first 3 primaries entering into the tip, rest rapidly graduated. Tail shorter than wings, nearly even or a little rounded, tending to divaricate in the middle, the feathers broad and plane to their rounded ends. Feet strong; tarsus not shorter than middle toe. ♂ black and lustrous, without red or yellow; ♀ plain black or brown. Terrestrial, but not specially palustrine; eminently gregarious and polygamous, or rather communistic, never mating or building nests; thus parasitic, like the Old World cuckoos; no musical ability. To the single species long notorious in the U. S., a second

has lately been added; there are several others in the warmer parts of America, all of the same irregular and objectionable tendencies.

Analysis of Species and Varieties.

♂, steely black with brown head.
Larger: ♂, wing over 4.00; tail over 3.00: ♀, wing about 3.75; tail about 2.75 . . . . . *ater* 313
Smaller: ♂, size of ♀ of the foregoing . . . . . *obscurus* 314
♂, brassy black, including head; eyes red; wing near 5.00; tail nearly 4.00 . . . . . *æneus* 315

313. M. a'ter. (Lat. *ater*, black. Fig. 258.) Common Cowbird. Cuckold. ♂, adult: Lustrous green-black, with steel-blue, purple, and violet iridescence. Head and neck deep wood-brown, with some purplish lustre. Bill and feet black. Length 7.50–8.00: extent 13.50; wing about 4.50, at least over 4.00; tail about 3.25; bill 0.70; tarsus 1.00–1.10. ♀, adult: An obscure-looking bird, dusky grayish-brown, nearly uniform, but paler below than above, where most of the feathers have dusky centres, and most of those of the under parts with dark shaft lines; giving a somewhat streaky appearance. There is some gloss on the upper parts, particularly on the wings and tail, where a slight greenish lustre is usually evident. Bill blackish-brown, paler below; feet blackish-brown. Smaller than the ♂. Length 7.00–7.50; wing about 3.75; tail 2.75. Young ♂ ♀: Similar to the ♀ adult; still duller, and more variegated; upper parts dusky brown, the feathers skirted with gray, producing a set of semicircles on the back; below, pale grayish, or even ochrey-brown, everywhere streaked with dusky. The sexual difference in size soon appreciable, and the black of the ♂ soon begins to appear in patches.

Fig. 258. — Cowbird, reduced. (Sheppard del. Nichols sc.)

Am. at large; migratory, abundant, gregarious, polygamous, parasitic. The singular habits of this bird, shared by others of the genus, form one of the most interesting chapters in ornithology. Like the European cuckoo, it builds no nest, laying its eggs by stealth in the nests of various other birds, especially warblers, vireos, and sparrows; and it appears to constitute, furthermore, a remarkable exception to the rule of conjugal affection and fidelity among birds. A wonderful provision for the perpetuation of the species is seen in its instinctive selection of smaller birds as the foster-parents of its offspring; for the larger egg receives the greater share of warmth during incubation, and the lustier young cowbird asserts its precedence in the nest: while the foster-birds, however reluctant to incubate the strange egg (their devices to avoid the duty are sometimes astonishing), become assiduous in their care of the foundling, even to the neglect of their own young. The cowbird's egg is said to hatch sooner than that of most birds: this would obviously confer additional advantage. The list of birds in whose nests cowbirds' eggs have been found includes a large number of finches, warblers, greculets, flycatchers, etc.; there seems to be really little choice. While *small* species are usually victimized, this is not always the case. I have found eggs in nests of the kingbird and towhee bunting. In the West, where cowbirds swarm about the ranches and settlements, it is the rule, I almost said, to find their eggs in nests of the prairie *Fringillidæ*, etc. The egg is usually single; sometimes 2, 3, even 4 are found in a nest; they range from 0.80–1.00 in length, by 0.65–0.70 in breadth, and are white, fully speckled and dashed with browns and neutral tints.

314. M. a. obscu'rus. (Lat. *obscurus*, dark.) Dwarf Cowbird. Similar; smaller: ♂ the size of ♀ *M. ater;* ♀ under 7.00: wing 3.33; tail 2.33. The difference is strongly marked, and

apparently constant. Southwestern U. S., Texas to California, the resident form, breeding there, while *M. ater* passes on, though the two are associated during the migration of the latter. Swarming like *M. ater;* eggs as in that species, but smaller; only up to about 0.80 × 0.60.

315. **M. æ'neus.** (Lat. *æneus* or *ahenius*, brassy, bronzy; *æs*, brass.) BRASS COWBIRD. BRONZED COWBIRD. RED-EYED COWBIRD. ♂, adult: Entire body and head black, splendidly lustrous with bronzy reflections, the tint much like that of the back of *Quiscalus æneus*. This rich brassy-black uniform over the whole bird, there being no distinction of color between the head and body, as in *M. ater*. The bronze only on the ends of the feathers, the covered parts of which are violet-black, with plain dusky roots. Wings and tail black, with violet, purple, and especially green metallic lustre on the upper surfaces. Under wing- and tail-coverts chiefly violaceous-black; the purplish and violaceous tints most noticeable on the upper coverts of both wings and tail, the reflections of the quill-feathers themselves being chiefly green. Bill ebony-black. Feet black. Iris red. Length 8.00–8.50; extent about 15.00; wing 4.50–4.75; tail 3.25–3.50; tarsus 1.15–1.25; bill 0.90 along culmen, very stout and especially deep at base, much compressed; lateral outlines concave; under outline straight; upper gently convex throughout; tip very acute. ♀ notably smaller: wing scarcely over 4 inches; tail about 3.00; culmen scarcely 0.75; tarsus 1.00. Color not brown, as in *M. ater* ♀, but uniformly quite black, with considerable gloss, though nothing like the brassy splendor of the ♂. Wings and tail with greenish reflections. Young ♂: Uniform dull black, faintly violaceous on back and rump, greenish on wings and tail. Early spring birds, in imperfect dress, are exactly like the adult ♀ in color, but much larger. Mexico to the Lower Rio Grande, abounding in some places; a large and very handsome Cowbird, recently added to our fauna. Polygamous and parasitic like the others, but egg entirely different, being greenish-white, without markings; size 0.85–0.95 in length by 0.65–0.75 broad; average 0.90 × 0.70. Found in nests of *Icteria*, *Icterus*, *Cardinalis*, *Milvulus*, *Tyrannus*, etc.

FIG. 259. — Marsh Blackbird, ♂, reduced. (Sheppard del. Nichols sc.)

100. **AGELÆ'US.** (Gr. *ἀγελαῖος*, *agelaios*, gregarious; *ἀγέλη*, a flock.) RED-WING MARSH BLACKBIRDS. Bill about as long as head, stout at base, where deeper than broad, upper and under outlines on an average about straight; commissure variously sinuate or bent; culmen high on forehead, where flattish and broadly parting the feathers; bill rapidly tapering to an acute tip. Wings pointed, but 1st primary not longest; usually 2d–4th entering point of wing. Tail even or little rounded, of broad feathers widening a little to very obtuse ends, somewhat divaricate in the middle. Tarsus a little longer than the bill. Our three forms are very closely related: the ♂ uniform lustrous black, with bend of wing red; 8.00–9.00 long; wing 4.50–5.00; tail 3.50–4.00. The ♀ everywhere streaked; above blackish-brown with pale streaks, inclining on head to form median and superciliary stripes; below, whitish, with many sharp dusky streaks; sides of head, throat, and bend of the wing, tinged with reddish or fulvous; under 8.00; wing about 4.00; tail 3.25. The young ♂ at first like the ♀, but larger, apt to have a general buffy or fulvous suffusion, with bright bay edgings of the feathers of back, wings, and tail, and soon showing black patches. The ♀ ♀ are scarcely distinguishable: the ♂ ♂ may be determined as follows:

Analysis of Species and Varieties.

Middle wing-coverts buff, bordering the bright red patch . . . . . *phœniceus* 316
Middle wing-coverts buff, but black-tipped, usually leaving red patch without buff border . *gubernator* 317
Middle wing-coverts white, bordering the dark red patch . . . . . *tricolor* 318

316. A. phœni'ceus. (Gr. φοινίκεος, *phoinikeos*, Lat. *phœniceus*, red, of a color introduced in Greece by the Phœnicians. Fig. 259.) BLACKBIRD. MARSH BLACKBIRD. RED-WINGED BLACKBIRD. RED-AND-BUFF-SHOULDERED MARSH BLACKBIRD. ♂: Lesser wing-coverts scarlet, like arterial blood, broadly bordered by brownish-yellow, or brownish-white, the middle row of coverts being entirely of this color; sometimes the greater row, likewise, are mostly similar, producing a patch on the wing nearly as large as the red one; occasionally, there are traces of red on the edge of the wing and below; in some specimens the bordering is almost pure white, instead of buff. Extremes: ♂, length 8.25–9.85; extent 13.60–15.30; wing 4.35–5.00; tail 3.12–3.90; bill 0.75–1.00; average: Length 9.00; extent 14.50; wing 4.65; tail 3.60. ♀, length 7.35–8.55; extent 11.85–13.55; wing 3.65–4.25; tail 2.65–3.20; bill 0.70–0.80; average: Length 7.65; extent 12.35; wing 3.85; tail 3.00; bill 0.75. The extremes here given not often seen. Southern-bred birds are much smaller as well as glossier. Temperate N. Am., but chiefly E. of the Rocky Mts.; breeding anywhere in its range, wintering from about 35° southward. From its general dispersion in low or wet thickets or fields, swamps, and marshes, the blackbird collects in August and September in immense flocks, thronging the extensive tracts of wild oats and other aquatic plants in marshes and along water courses, also visiting and doing much damage to grain-fields. Thousands are destroyed by boys and pot-hunters, but the hosts scarcely diminish, and every known artifice fails to protect the crops from the invasion of the dusky hordes. At other seasons the "maize-thief" is innocuous, if not positively beneficial, as it destroys its share of insects. Nest usually in reeds or bushes near the ground, or in a tussock of grass, or on the ground; occasionally in small trees, vines, and shrubbery; a bulky structure of coarse fibrous materials, usually strips of rushes, sedges or marsh grass, lined with finer grasses; eggs 4–6, 1.00 × 0.75, May and July, pale blue, fantastically dotted, blotched, clouded, and scrawled over with dark or even blackish-brown, and paler or purplish shell-marks. The usual note is a guttural *chuck;* in the breeding season the "creaking chorus" makes an indescribable medley.

317 A. p. guberna'tor. (Lat. *gubernator*, a governor, alluding to the red epaulettes, as if a sign of rank or command.) RED-SHOULDERED MARSH BLACKBIRD. Lesser wing-coverts scarlet, as before, narrowly or not at all bordered with buff, the next row having black tips for all or most of their exposed portion, so that the brownish-yellow of their bases does not show much, if any. Pacific Coast, U. S. and British Columbia. Scarcely different; ♀ indistinguishable from ♀ *phœniceus*.

318. A. tri'color. (Lat. *tricolor*, three-colored; red, white, and black.) RED-AND-WHITE-SHOULDERED MARSH BLACKBIRD. Lesser wing-coverts dark red (like venous blood), bordered with pure white. Besides this obvious distinction from *phœniceus*, the bill is usually slenderer and the tail is less rounded; the gloss of the plumage is bluish, not greenish (appreciably so in the ♀ as well as in the ♂?). ♀ with median wing-coverts white-edged. California and Oregon, especially coastwise; resident or scarcely migratory. General habits the same; nest and eggs indistinguishable.

101. XANTHOCE'PHALUS. (Gr. ξανθός, *xanthos*, yellow; κεφαλή, *kephale*, head.) YELLOW-HEADED BLACKBIRDS. General characters of *Agelæus;* claws more developed, the lateral reaching much beyond base of the middle. Tail more nearly even, with narrower feathers. Wings long and pointed; tip formed by outer 3 quills. Colors black, white, and yellow.

319. X. icteroce'phalus. (Gr. ἴκτερος, *ikteros*, Lat. *icterus*, yellow. Fig. 260.) YELLOW-HEADED BLACKBIRD. ♂: Black, including lores and small space around eye and bill; whole head otherwise, with the neck and breast, rich yellow, orange in high feather, the color extending

interruptedly to or towards the belly; some feathers around vent, and the tibiæ, usually yellow also. A large white patch on the wing, formed by the primary and many of the greater secondary coverts, interrupted by black of the bastard quills. Bill and feet black. Length 10.00–11.00; extent 16.50–17.50; wing about 5.50; tail 4.50; bill 0.75–1.00; tarsus 1.25. In less perfect dress, the yellow overcast with dusky. ♀, adult: Dark brown, including back of head and neck; line over eye, throat and breast dull yellow, with dusky maxillary streaks; usually there are whitish feathers in the yellow, and sometimes the same in the black of breast. No white wing-patch. Bill dark brownish horn-color; feet blackish. Much smaller. Length 8.00–9.50; extent scarcely 14.00; wing under 5.00; tail under 4.00. Nestlings are snuffy-brown; the sprouting wing-feathers black, already showing white; feet flesh-color. It is useless to pursue the endless color variations; the species is unmistakable. Western U. S. and British Provinces to 58°; E. regularly to Illinois, Iowa, Wisconsin, etc., casually to Pennsylvania, Massachusetts and Greenland; S. into Mexico; migratory, very abundant. Its distribution is general on the prairies, but irregular; it flocks about ranches and settlements, and collects in colonies to breed in marshy spots, anywhere in its general range. Nest a light but large thick-brimmed fabric of dried reeds and grasses, slung to growing ones, 5–6 inches in diameter, about as deep; eggs 3–6, 1.00–1.15 long by 0.75 broad; grayish-green, spotted, as in *Scolecophagus*, with reddish-brown, not scrawled as in *Agelæus*. A fine large species, conspicuous by its yellow head among the several blackbirds that troop together in the West.

FIG. 260. — Yellow-headed Blackbird, reduced. (Sheppard del. Nichols sc.)

23. Subfamily STURNELLINÆ: Meadow Starlings.

If the marsh blackbirds, orioles, and crow blackbirds be respectively entitled to represent subfamilies of *Icteridæ*, the meadow starlings seem to be equally entitled to such distinction; and I find that by making *Sturnella* (with *Trupialis*) the type of a subfamily, the *Agelæinæ* are susceptible of better definition. The characters are included under head of the type genus.

102. **STURNELLA.** (Irregular dimin. of Lat. *sturnus*, a starling. Fig. 261.) MEADOW LARKS. (Name "lark" objectionable and misleading, but apparently ineradicable.) A remarkable genus of *Icteridæ*. Bill along culmen longer than head, shorter than tarsus; depth at base about ⅓ the length; outlines about straight above and below, and along commissure to the strong bend near its base. Culmen flattened throughout, extending broad and far into feathers of forehead; laterally, the frontal feathers reaching the narrow scaled nostrils. Inner lateral toe rather longer than outer, claw of neither reaching base of middle claw. Hind toe long, with a great claw twice as large as the middle one. Feet very large and stout, reaching beyond the end of the tail when outstretched; eminently fitted for terrestrial locomotion. Wings short and much rounded; little difference in lengths of 1st–5th quills; enlarged inner secondaries nearly covering them in closed wing. Tail very short, rounded, of narrow, acute feathers. Feathers of crown stiffish, bristle-tipped. No other genus approaches *Sturnella*, excepting *Trupialis*,

which is much the same, with red in place of yellow. Contains several imperfectly differentiated conspecies, 3 of this country.

Analysis of Conspecies.

Common Characters. — Prevailingly variegated: each feather of the back blackish, with a terminal reddish-brown area, and [illegible]: neck similar, the pattern smaller; crown streaked with black and brown, and with [illegible] superciliary stripe: a blackish line behind eye: several lateral tail-feathers white, the others, with the inner quills and wing-coverts, barred or scalloped with black, and brown or gray. Edge of [illegible] yellow, the sides and crissum flaxen-brown, with numerous [illegible] Black crescent (obscure in the young).

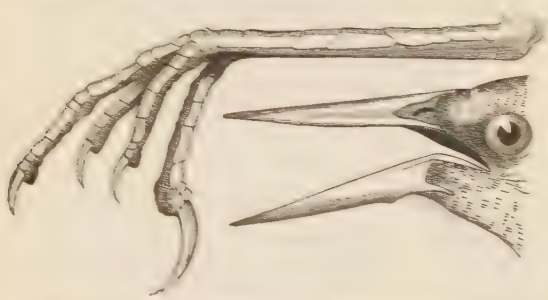
Prevailing tone [illegible] of chin confined to space between forks of the jaw; wings and tail with [illegible]

[illegible]: wing 4.50 or more . . . . . *magna* 320

[illegible] 321

Prevailing tone gray above: yellow of chin spreading on cheeks: wings and tail with alternating black and gray bars . . . . . *neglecta* 322

320. S. magna. (Lat. *magna*, large.) FIELD LARK. OLD-FIELD LARK. MEADOW LARK. The colors, as above described, rich and pure, the prevailing aspect brown; black streaks prevailing on crown; yellow of chin usually confined between rami of under mandible: black bars on wings and tail usually confluent along the shaft of the feathers, leaving the gray in scallops. Sexes similar: ♀ duller colored, the yellow paler. Young at first have little if any pale yellow, and the pectoral crescent indicated by a few streaks. Length of ♂ 10.00–11.00; extent about 17.00; wing 4.50 or more; tail 3.50; bill 1.35; tarsus 1.40. ♀: length 9.00–9.50; extent about 15.00; wing 4.25; tail 3.00. Varies greatly in size, like *Agelæus*: southern-bred birds much smaller than northern. Eastern U. S. and British Provinces; N. to about 54°; mixing in the Upper Mississippi valley with *neglecta*, and extending to edge of the plains; everywhere abundant in open country; winters usually from the Middle States southward; imperfectly migratory; [illegible] gregarious when not breeding; strictly terrestrial; an agreeable vocalist. Breeds [illegible] on the ground, usually [illegible] or covered in some way [illegible] grass-bunch. Eggs 4–6, crystal white, speckled with reddish and purplish; very variable in size, averaging about 1.10 × 0.80. Two or three broods may be reared.



FIGS. 261. — Bill and foot of *Sturnella*, nat. size. (Ad nat. [illegible])

321. S. m. mexicana. (Lat. Mexican.) MEXICAN MEADOW LARK. Very similar; the browns [illegible]-brown; black at a maximum; yellow very rich. Size smaller; wing of ♂ about 4.25; bill and feet relatively larger; bill 1.20; tarsus 1.60. Mexico to [illegible].

322. S. neglecta. Lat. *neglecta*, not selected, overlooked; as the variety long was.) WESTERN [illegible]. [illegible] smaller and paler, the prevailing aspect gray; black at a minimum, and [illegible] on the crown; yellow of chin usually encroaching on sides of [illegible], and on wings and tail usually resolved into distinct bars alternating with gray bars. Western U. S. from Dakota to the Pacific. General habits, manners, and appearance the same, but song said to be different.

24. Subfamily ICTERINÆ: Orioles.

Non-gregarious insectivorous and frugivorous species, strictly arboricole; of brilliant or striking [illegible] colors, and pleasing song; distinguished as architects, constructing elabo-

rately woven pensile nests. With the bill relatively longer, as well as slenderer and more acute than in most of the *Icteridæ;* the feet weaker, exclusively fitted for perching. Three of our species are migratory birds, abundant in summer; the rest merely reach our southern border from tropical America.

103. ICTERUS. (Gr. ἴκτερος, *ikteros*, Lat. *icterus*, yellow. Fig. 262.) ORIOLES. Our single genus of the subfamily: characters practically the same. Bill averaging as long as head (more or less); very acute, sometimes decurved. Feet fitted for perching, not for walking; tarsus not longer than middle toe and claw. Lateral toes, if not of equal lengths, outer longest (the rule in *Fringillidæ;* in *Icteridæ* the reverse). Wings usually pointed and averaging equal to (longer or shorter than) the rounded or graduated tail. A large and beautiful genus, the species of which vary much in details of form, but are not easily divided otherwise than specifically. The colors are striking: the males black with orange or yellow, usually also with white; in one species, black and chestnut. The sexes very unlike. The ♀ ♀ of several species closely resemble one another, though the ♂ ♂ are very different. Two Eastern species; one Western; the rest Southwestern.

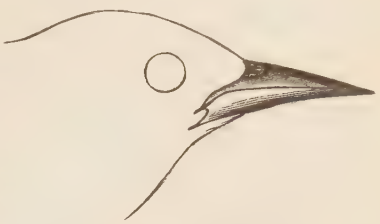


FIG. 262. — Bill of an Oriole.

Analysis of Species.

The ♂ black and chestnut: *spurius, affinis.*
The ♂ black and orange: *galbula, bullocki, cucullatus.*
The ♂ black and clear yellow: *parisorum, auduboni, vulgaris.*

Feathers of throat soft and normal.
♂ black and chestnut; ♀ olivaceous and yellowish. Length 7.00 or less . . . . . *spurius* 324, 325
♂ black and orange, or flame-color.
Tail rounded, not longer than wings.
♂ head and neck all around black; white on wings in bars . . . . . *galbula* 326
♂ crown and throat black, sides of head orange. White patch on wings . . . . *bullocki* 327
Tail graduated; outer feathers an inch shorter than middle ones; longer than wings.
♂ head orange, with black mask . . . . . *cucullatus* 328
♂ black and pure yellow.
♂ head, neck, breast and back black. Sexes unlike; length about 8.00 . . . . . *parisorum* 329
♂ ♀ head, neck, and breast black; body yellow, greenish on back; length about 9.00 . *auduboni* 330
Feathers of throat elongate and lanceolate. Sexes alike. Length about 10.00.
♂ ♀ Black and yellow, with white on wings . . . . . *vulgaris* 323

323. I. vulga'ris. (Lat. *vulgaris*, vulgar, common.) TROUPIAL. Bill acute, attenuated, elongate, and somewhat decurved. Throat-feathers lengthened, loosened, and lanceolate. Bare space around eye. Adult ♂ ♀: Head and neck all around, fore breast, isolated dorsal area, wings and tail, black. Rump, upper tail-coverts, cervical collar, and under parts of the breast, rich yellow. Wings with white patch on coverts and much white edging of secondaries. Large: length about 10.00; wing and tail 4.50; bill over 1.00. A common and well-known species of Tropical America, said to have strayed to the Southern States. No late cases of so doing. (The species would be better enumerated next after No. 330.)

324. I. spu'rius. (Lat. *spurius*, spurious; the species was formerly called "bastard Baltimore oriole," whence the undeserved name.) ORCHARD ORIOLE. Adult ♂: Black and chestnut. Head and neck all around, fore breast and back, black. Rump and upper tail-coverts, lesser and under wing-coverts, and whole under-parts from the breast, chestnut or chocolate-brown. Wings and tail black, former except as said, and some white or whitish edging of the quills and tipping of the greater coverts, the latter forming a wing-bar; outer tail-feathers sometimes with a touch of chestnut. Bill and feet blue-black. Length about 7.00; extent about 10.00; wing 3.00–3.25; tail nearly as long, much rounded, its graduation nearly 0.50; bill 0.70 along culmen, very slender and acute, somewhat decurved; tarsus 0.90. ♀, adult: Smaller than the

♂. Above, dull yellowish-olive, clearest on head, rump, and tail, obscured on the back. Below, sordid yellowish. Wings plain dusky, glossed with olivaceous, with whitish edging, much as in the ♂. An inconspicuous object, but known from other ♀ orioles by its small size and slender bill, a little curved. Young ♂: First year like ♀, but larger; second year like ♀, but with a black mask on the face and throat. Afterward showing confused characters of both sexes. Three years required to assume the full dress. Eastern U. S., strictly; rarely N. to Maine, Canada; W. to the high central plains. Breeds throughout its U. S. range; winters extralimital. Abundant in orchards, parks, streets, the skirts of woods, etc. The nest is one of the most perfect examples of a woven pensile fabric, even in a group of birds distinguished as the orioles are for the dexterity and assiduity they display in their elaborate textile *rostrifactures*. They antedate Howe in the expedient of placing the eye of a needle at its point — that which revolutionized hand-sewing, and made sewing-machines practicable: for their bill works to precisely the same effect. The orchard oriole's nest is generally more compact and homogeneous than the Baltimore's, woven chiefly of slender grass-blades which cure in the sun like good hay, long retaining some greenness, which tends to its concealment in the foliage. It is smaller, less deep in proportion, and often not so strictly pendant from its forked twig. Eggs smaller than the Baltimore's, scarcely 0.85 × 0.60, and spotty rather than scrawly.

325. I. s. affi'nis. (Lat. *affinis*, affined, allied.) Texas Orchard Oriole. Smaller: ♂ little over 6.00; wing usually under 3.00. Texas: Southern race, scarcely distinguishable.

326. I. gal'bula. (Lat. *galgula* or *galbula*, some small yellow bird of the ancients. "Baltimore" is not from the city of that name, but from the title of Sir George Calvert, first baron of Baltimore: the colors of the bird being chosen for his livery, or resembling those of his coat-of-arms. Fig. 263.) Baltimore Oriole. Golden Robin. Firebird. Hangnest. Adult ♂: Black and orange. Head and neck all round, and the back, black; rump, upper tail-coverts, lesser and under wing-coverts, most of the tail-feathers, and all the under parts from the throat fiery orange, but of varying intensity according to age and season. Middle tail-feathers black; wings black, the middle and greater coverts, and inner quills, more or less edged and tipped with white, but the white on the coverts not forming a continuous patch; bill and feet blue-black, or dark grayish-blue. Length 7.50–8.00; extent 11.50–12.50; wing 3.66; tail 3.00. ♀ smaller, and much paler, the black obscured by olive, sometimes entirely wanting. Above, mixed dusky and yellowish-olive, somewhat overcast with a gray shade. Below, dull orange, more or less mixed with whitish, and usually with black traces on the throat. Tail and its upper coverts dull yellowish, the central feathers usually blackish. Bill and feet lighter plumbeous than in the ♂. Young ♂ entirely without black on throat and head, otherwise colored nearly like the ♀. Below, dull orange yellow whitening on throat, shaded with olive on sides. Above, olive, more yellowish on rump and tail, but latter without black; middle of back obscured with dusky centres of the feathers; wings dusky, with two white bars and white edgings of the inner quills. In some splendid featherings, particularly from the Mississippi valley, the orange becomes intense flame-color, and there is so much white on the wings as to approach the character of *I. bullocki*. U. S. and adjoining British Provinces; W. to the plains, and reaching toward the Rocky Mts. This is one of our famous beauties of bird-life, noted alike for its flash of color, its assiduity in sing-

Fig. 263. — Baltimore Oriole, reduced. (Sheppard del. Nichols sc.)

ing, and its skill at the loom; its elaborately fabricated and perfectly pensile nests swaying from the tops of our shade-trees, which have one charm added when fired with such brilliancy as the oriole brings to contrast with verdure. Eggs 4–6, nearly 1.00 × 0.65, thus rather elongate; ground color a shaded white, irregularly spotted, blotched, clouded and especially scrawled with blackish-brown and other heavy surface colors, together with subdued shell-markings.

327. **I. bul'locki.** (To Wm. Bullock, of London. Fig. 256.) BULLOCK'S ORIOLE. Adult ♂: Similarly black and orange, the orange invading the sides of the head and neck and the forehead, leaving only a narrow space on the throat, the lores, and a line through the eye, black; a large continuous white patch on the wing, formed by the middle and greater coverts. Larger than the Baltimore. Length 8.00–8.50; extent 12.50–13.50; wing 4.00; tail 3.40. ♀: Olive-gray, below whitish, all the fore parts of the body and head tinged with yellow; the wings dusky, with two white bars, but the tail and its under coverts quite yellowish. ♀ thus very closely resembling the ♀ Baltimore, and more detailed description may be desirable. Larger: length about 8.00; extent 12.00; wing 3.75; tail 3.25. Above olive-gray, becoming quite gray on the rump, brightening into olive. Yellow on nape, upper tail-coverts and tail. Forehead, superciliary line, sides of head and neck, and large space on breast, bright yellow; lores and throat white. Other under parts grayish-white, tinged with yellow on the under tail-coverts. Edge and lining of wing yellow; middle coverts broadly edged and tipped with white; greater coverts and quills less conspicuously edged. Young ♂ at first like the ♀, soon, however, showing black and orange; in one stage with a black throat patch. Western U. S., in woodland, abundant, replacing the Baltimore, to which it is so closely allied, and with which it corresponds in habits and manners.

328. **I. cucul'la/tus.** (Lat. *cucullatus*, wearing the *cuculla*, a kind of hood or cowl.) HOODED ORIOLE. Adult ♂: Orange and black. General color orange; from rich chrome yellow to flame-color. Middle of back (scapulars and interscapulars) black. A black mask, embracing eyes, a narrow frontal line, and patch on chin, cheeks, and throat. Wings black, with white edging of the quills and coverts. Tail black, some or all of the feathers usually with narrow whitish tips. Bill and feet blue-black, the former extremely slender and somewhat decurved, 0.80; tarsus 0.90. Length 8.00; extent 10.50; wing 3.30; tail 3.50–4.00, thus longer than wings; the feathers narrow and lanceolate, the outermost an inch or so shorter than the central pair; such length, narrowness, and extreme graduation of the tail being a strong character. ♀, adult: Above, dull grayish-olive; tail and under parts dull yellowish; wings dusky, the quills and coverts edged with dull white. The ♀ thus resembles other species, but the long slender graduated tail and attenuated decurved bill are diagnostic. Fairly smaller than the ♂. Young ♂: At first like ♀, but bill pale at base below. Various intermediate states during progress to maturity; sometimes the black dorsal band interrupted by yellowish-gray, and the general orange obscured with the same. A frequent condition, when the general plumage is like that of the ♀, is to have a black frontlet and gorget, like *I. spurius* under the same circumstances. Southern Texas, New Mexico, Arizona and California, chiefly near the Mexican border. Nest woven like that of other orioles, very substantial and durable; in places where the Spanish moss grows, it is usually made of this material, and placed in a truss of the same. Eggs 3–4, sometimes 5, varying from 0.80 to 0.90 long by 0.60 broad, usually quite pointed at both ends; color white, with the usual scrawling. In the Lower Rio Grande valley this is the commonest oriole in some places.

329. **I. pariso'rum.** (To the brothers Paris.) BLACK-AND-YELLOW ORIOLE. PARIS' ORIOLE. Adult ♂: Black and clear yellow. Below from the breast, rump, and upper tail-coverts, lesser, middle and under wing-coverts, both above and below, and basal portions of all the tail-feathers, except the central ones, clear yellow; greater wing-coverts tipped, inner quills edged, with white. Head, neck, breast, and back, black. On the tail, the yellow occupies the

basal half of the lateral feathers, but only the extreme base of the central pair. Length 8.00; extent 12.00; wing 4.00; tail 3.40–3.60, moderately rounded, the lateral feathers graduated about 0.50; bill 0.90, attenuate and slightly decurved; tarsus 1.00. Young ♂: The black parts all overcast with grayish-olive skirting of the feathers, giving the prevailing tone on the upper parts, but on the breast the black showing more clearly. The yellow likewise obscured with grayish-olive, especially on the rump. Tail greenish-yellow, the middle feathers blackening. Wings dusky, all the quills and the greater and middle coverts broadly edged and tipped with white. ♀? resembling the last described; less white on the wings; central tail-feathers simply fuscous like the ends of the others. Southern Texas, New Mexico, Arizona and Southern California, near the Mexican border. Not yet well known or found breeding in the U. S. Nesting essentially the same as that of other orioles, often in bunches of moss or vines hanging in cactuses, quite near the ground; eggs 0.90 × 0.65, whitish, variously blotched and dotted with purplish and blackish-browns.

330. I. melanocephalus auduboni. (Gr. μέλας, *melas*, gen. μέλανος, *melanos*, black; κεφαλή, *kephale*, head. To J. J. Audubon.) Black-headed Oriole. Audubon's Oriole. Adult ♂: Black and clear yellow. Entire body rich gamboge-yellow, without orange or flame tint, but shaded with greenish on back, sides, and upper tail-coverts; under tail-coverts pure yellow, like the belly. Middle and lesser wing-coverts and lining of wings pure yellow, the former with black bases concealed by the yellow tips. Head all around, fore neck and breast, glossy jet-black, without any concealed yellow, except at edges of the black on the breast — the black there thus ending ragged, different from the clean-cut border of *cucullatus*. Wings black, the outer webs of the quills white-edged, especially on inner secondaries and outer primaries toward their end; greater coverts with white spot at end of outer web. Tail black, the outer feathers more or less edged and tipped with white. Bill and feet plumbeous-blackish, former paler at base below. Length 9.25–9.75; extent 12.50–13.00; wing 4.00; tail rather more, much graduated, the outer feathers 1.00 or more shorter than the middle. Bill stout, straight, almost as in *Agelaeus;* culmen fully 1.00. Tarsus 1.10; middle toe and claw the same. Adult ♀: Quite like the ♂; not smaller, and little different in color, contrary to the rule in the genus and family. Back rather more olivaceous; wings rather more edged with white; outer tail-feather edged and tipped with whitish. The sexual characters long remained undetermined. This fine oriole is little known: it is a large beautiful species, occurring in the U. S. only, as far as known, in the Lower Rio Grande valley; thence southward running into the true Mexican *melanocephalus*. Said to be a magnificent songster, and a favorite cage bird. Nest half-pensile, woven of grasses; eggs 0.95–1.00 by 0.67–0.72, white dusted with fine brown specks, over which are stains and splashes of dark brown and lilac, with the coarse blackish [illegible] usual in this genus.

25. Subfamily QUISCALINÆ: Crow Blackbirds; Grackles.

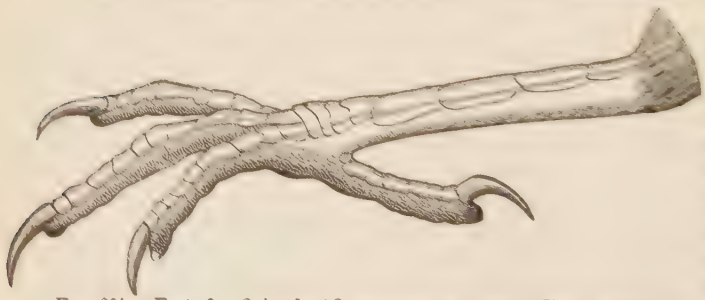


Fig. 264. — Foot of a *Quiscalus* (*Q. macrurus*, nat. size). (From Baird.)

Closely resembling the *Agelaeinæ* both in structure and in habits, these birds are distinguished by the length and attenuation of the bill, with decidedly curved culmen, especially towards the end, more or less sinuate commissure, and strongly inflected tomia. The bill is quite caltrimostral, and the typical [illegible]

crow-like aspect; but they are readily distinguished by several features, besides 9 instead of 10 primaries. The feet are large and strong, and the birds spend much of their time on the ground, where they walk or run instead of advancing by leaps. They generally build rude, bulky nests, lay spotted or streaked eggs, and their best vocal efforts are hardly to be called musical. The ♂ of all our species is lustrous black, with various iridescence, the ♀ merely blackish, or brown and *much* smaller. There is only one genus (*Cassidix*) besides the two of this country: in *Scolecophagus* the tail is slightly rounded and shorter than the wings; in *Quiscalus* the tail is graduated, and nearly equals or exceeds the wings. They are not specially palustrine. Individuals of all the species abound, especially in the South and West; only two are common Eastern birds.

104. SCOLECO'PHAGUS. (Gr. σκώληξ, gen. σκώληκος, *scolex, colecos*, a worm: φαγος, *phagos*, eating.) Rusty Grackles. Thrush Blackbirds. Bill shorter or not longer than head, slender for the subfamily, and somewhat like a robin's, for instance; culmen little convex, if any, except at the decurved tip; gonys slightly convex; cutting edges inflexed, commissure little sinuated. Wings pointed, decidedly longer than the nearly even tail; point formed by the outer 4 primaries. Tail much as in *Agelæus* in size and shape. Tarsus rather longer than middle toe and claw. Lateral toes short, with moderate claws, scarcely or not reaching base of middle claw. Nest in bushes. Eggs spotty, not veiny and streaky.

Analysis of Species.

Smaller: wing under 5.00. Bill slender, thrush-like. ♂ greenish-black, including head. Sexes very unlike: ♀ quite rusty-brown, even with chestnut; a light line over eye . . . . . *ferrugineus* 331

Larger: wing 5.00 or more. Bill stouter, more blackbird-like. ♂ greenish-black, head more violet. ♀ subsimilar, sooty-brown, no pale superciliary stripe . . . . . *cyanocephalus* 332

331. S. ferrugi'neus. (Lat. *ferrugineus*, rust-colored; *ferrugo*, iron-rust: only applicable to ♀ and young.) Rusty Grackle. Thrush Blackbird. Adult ♂, in summer: One lustrous black with green metallic reflections; head not notably different from other parts in its iridescence. Bill and feet black. Iris creamy or lemon. (Not ordinarily seen in the U. S. in this full dress — usually with some rusty.) Length 9.00–9.50; extent 14.00–15.00; wing under 5.00; tail 4.00 or less; bill 0.80, only about 0.35 deep at base; tarsus 1.20; middle toe and claw less. Adult ♀ in summer: Slaty-blackish, duller below, with greenish reflections chiefly on wings and tail; nearly all the upper parts overlaid with rich rusty-brown, and under parts with a paler shade of the same; inner secondaries brown-edged; a whitey-brown streak over eye; iris brown. Moderately smaller than the ♂. The young ♂ at first resembles the ♀, but is larger, and shows more decidedly lustrous black, especially on wings and tail. As usually found in flocks in the U. S., in fall, winter, and early spring, young and old of both sexes are very rusty, with light line over eye. Eastern North Amer., N. W. to Alaska; in the U. S., W. to Dakota, Nebraska, etc., meeting and mixing in the fall with the next species. In winter, generally dispersed over the E. U. S.; breeds from N. New England northward. Nesting and eggs like those of *Xanthocephalus*; breeding in loose colonies, in swampy tangle; nest in bushes, of sticks and grasses mixed with mud, lined with fine grasses and rootlets; eggs usually 4, about 1.05 × 0.75, but very variable; dull greenish-bluish or grayish-white, flecked and mottled with dark brown, but with little or no line-tracery.

332. S. cyanoce'phalus. (Gr. κύανος, *kuanos*, Lat. *cyanus*, blue; κεφαλή, *kephale*, head.) Blue-headed Grackle. Brewer's Blackbird. Similar to the last, but quite a different bird. Adult ♂, in summer: Very lustrous green-black, as before, but with purple and violet iridescence, especially on head, where the violet or steel-blue sheen contrasts with the general greenish hue. Bill and feet black. Iris creamy or lemon. Larger: length averaging 10.00 — 9.75–10.25; extent 16.00 or more; wing 5.00–5.25; tail 4.00–4.25; bill 0.80, stout at base, where about 0.40 deep — more like an abbreviated *Quiscalus*-bill than a thrush's; tarsus 1.25–1.30; middle toe and claw 1.10–1.15. ♀, adult, in summer: Blackish, with dull greenish

shade on back, wings, and tail; more slaty-blackish below. Fore parts of body above, head and most under parts overlaid with brownish-gray, lightest on head and throat, never rich rusty-brown. No light superciliary line. Iris brown. There is thus much less sexual difference than in *S. ferrugineus*. Smaller; size about that of ♂ *ferrugineus;* length 9.00–9.50; extent 14.50–15.50; wing 4.50–4.90, etc. Young ♂ resembling ♀; soon, however, showing more lustre, overcast with grayish (not rusty) brown, in same style as *ferrugineus*, but different shade. Western U. S., and adjoining British Provinces; E. to eastern edge of the plains, overlapping the migratory range of *S. ferrugineus;* W. to the Pacific. Breeds nearly throughout its range, in suitable places; migratory to and from extremes of its range. Nest and eggs substantially the same as those of *S. ferrugineus*.

105. **QUIS'CALUS**. (Span. *quisquilla*, Lat. *quisquilliæ? Vox barb.*, of uncertain meaning and application. See Coues, Check List, 2d ed., p. 64.) Crow Blackbirds. Bill about as long as head, quite cultrate and crow-like, but more attenuate and acute, with deflected cutting edges; upper and under outlines straightish to the terminal curve of culmen, but variable; commissure variously sinuate. Wings relatively shorter and less acute than in *Scolecophagus*, usually pointed by the 2d–4th quills, 1st and 5th shorter. Tail of varying development with the species; at its greatest, much longer than wings, at its least decidedly shorter; always graduated, the lateral feathers 1–3 inches shorter than the middle pair, in life capable of slanting upward on each side, so that the middle feathers make a keel below; whence the name "boat-tail." (Tail usually described as "longer than wings" in *Quiscalus;* but in most species it is decidedly shorter.) Feet stout; tarsus about equal to middle toe and claw. The ♂ ♂ in all the species "black," but so magnificently iridescent that little dead black is seen, being brassy, steel-blue, violet, purple, greenish, etc. ♀ subsimilar, or plain brown.

Analysis of Species and Varieties.

Tail decidedly shorter than wings, graduated 1.00–1.50. Sexes subsimilar.
- Iridescence various — green, blue, purple, violet. ♂ usually over 12.00 . . . . . *purpureus* 335
- Iridescence of back brassy; head steel-blue. ♂ usually over 12.00 . . . . . *æneus* 336
- Iridescence greenish, neck purple. ♂ usually under 12.00 . . . . . *aglæus* 337

Tail about equal to wings, graduated about 2.50. Sexes very different. ♀ brown . . . . . *major* 334

Tail decidedly longer than wings, graduated 2.50-3.50. Sexes very different. ♀ brown . . *macrurus* 333

333. **Q. macru'rus.** (Gr. μακρός, *macros*, long, large; οὐρα, *oura*, tail.) Fan-tailed Crow Blackbird. Texas Grackle. Of largest size, with longest, most keeled and graduated tail. Sexes very unlike. Bill very stout at base, tapering to the strongly deflected tip. Adult ♂: Iridescence chiefly purplish and violet, more greenish posteriorly. Length about 18.00; extent 23.00–24.00; wing 7.50–8.00; tail about 9.00, graduated 2.50–3.50; bill 1.75. Adult ♀: Dark brown; paler, grayish or whitish below. Length 13.00–14.00; extent 18.00–19.00; wing 5.50–6.00; tail little more. The species probably shades into the next, but presents dimensions the latter has not shown. Lower Rio Grande of Texas and southward, very abundant, swarming in the towns, where conspicuous by its curious antics as well as great size and numbers. Breeds in colonies, either in reedy marshes, when the nest is placed in the rushes over water, or anywhere about the settlements in trees away from water; sometimes there are many nests in one tree; some nests at an altitude of 30 or 40 feet. Nests built of any trash, usually with mud. Eggs in April–May, usually 3, 1.12–1.45 by 0.82–0.95, averaging 1.25 × 0.85; greenish or purplish-white, clouded oftener over smaller end than at the other, irregularly spotted, veined, and scratched with dark browns and blackish.

334. **Q. ma'jor.** (Lat. *major*, greater (than *Q. purpureus*).) Boat-tailed Crow Blackbird. Boat-tailed Grackle. Jackdaw. Of large size, with long, much keeled and graduated tail. Sexes very unlike. Bill stout at base, tapering to the deflected tip. Adult ♂: Iridescence mostly green, becoming purple or violet chiefly on the head and neck. Length 15.50–17.00, average 16.50; extent 21.00–23.50, average 22.50; wing and tail, each, 6.25–7.25,

average 7.00, latter rather the longer of the two; its graduation about 2.50; bill 1.50; tarsus nearly 2.00; middle toe and claw about the same. Adult ♀: Astonishingly smaller than the ♂, lacking entirely the great development of the tail, and easily to be mistaken for another species. Length 12.00–13.50, average 13.00; extent 17.25–18.25, average 17.75; wing 5.25–6.00, average 5.67; tail 4.75–5.50, average 5.25. General color plain brown, only darker on wings and tail; below brownish-gray, frequently whitening on the throat. South Atlantic and Gulf States, on the coast, abundant; N. regularly to the Carolinas, frequently to the Middle districts, but not to New England, as far as certainly known, though very likely in exceptional cases. This species differs from the common crow blackbird in being strictly maritime, with the consequent modification in food and habits; it may be seen at times wading in the water, and small fish and crustaceans form much of its fare. Nesting and eggs as in *Q. macrurus;* eggs averaging smaller, but not distinguishable with certainty.

335. Q. purpur'eus. (Lat. *purpureus*, purple. Fig. 265.) PURPLE CROW BLACKBIRD. COMMON CROW BLACKBIRD. PURPLE GRACKLE. Of medium size, with moderately keeled and graduated tail, shorter than wings. Sexes subsimilar. Bill usually less tapering and deflected at tip, but very variable. Adult ♂: Iridescence very variable with season, age, and sexual vigor, as well as on different parts of the body; but always intense in healthy adults, and at its height during the love-ardor; variously purple, green, blue, violet, and bronzy; not the extensive green of the last species, nor usually the *decided* brassy of the next variety; wings and tail mostly purplish; dark purplish and steel-blue on head, neck, and breast; back more greenish or bronzy. Bill and feet ebony black. Iris straw-yellow. Length 12.00–13.50; extent 17.00–18.50; wing 5.00–6.00, averaging 5.60; tail 4.50–6.00, usually under 5.50; bill 1.25, very variable; tarsus 1.25; graduation of tail 1.00–1.50. Adult ♀: Blackish, and quite lustrous; sufficiently similar to the ♂; length 11.00–12.00; wing about 5.00; tail about 4.50. Birds of this character, without perfectly brassy back and steel-blue head, are the usual kind in the Atlantic States; abundant and generally distributed, migratory and gregarious, breeding anywhere in their range, but chiefly northerly. Nesting variable, in tree or bush, on bough or in a hollow, at any height; sometimes in an artificial retreat, or a fish-hawk's nest. Nest bulky, of any trash, usually with mud; eggs of the character and with all the indescribable variability of others of the genus; usually bluish or greenish, with purplish veining and clouding, zigzagged and flourished with dark browns or blackish; averaging 1.25 × 0.90 in size; 5–6 in number. The grackles are absent from their breeding-grounds for only a small part of the year, when they flock southerly, often in immense bands scouring about for food. At times they are very injurious to the crops, but this is offset by their destruction of noxious insects. The courtships of the males look very curious to a dispassionate observer, being carried on with the most grotesque actions and ludicrous attitudes, as well as curious vocalization.

FIG. 265. – Purple Grackle, reduced. (Sheppard del. Nichols sc.)

336. Q. p. æ'neus. (Lat. *æneus*, brassy.) BRONZED CROW BLACKBIRD. BRASS GRACKLE. Birds from the interior U. S., especially the Mississippi valley, acquire in full plumage a splendid iridescence of three kinds, in pretty distinct areas. Body uniform shining brassy. Hind neck and breast chiefly steel-blue. Wings and tail chiefly violet and purple. This brilliant coloration is that represented by Audubon, pl. 221 of the 8vo. ed. Such birds occur

from New England, Hudson's Bay, the Saskatchewan and Rocky Mts. to Texas and the Gulf States.

337. Q. p. aglæ'us. (Gr. ἀγλαίος, *aglaios*, splendid.) FLORIDA CROW BLACKBIRD. GREEN GRACKLE. Birds resident in S. Florida are smaller than average *purpureus*, with relatively longer and slenderer bill more decurved at tip; the body lustre chiefly greenish; head and neck chiefly violaceous steel-blue; wings and tail steel-blue, becoming violet on the coverts. Averaging an inch less in length than *purpureus*, and other parts in proportion, excepting the bill and feet, which are quite as long. (*Q. baritus*, Bd., 1858, nec auct. *Q. aglæus*, Bd., 1866.)

18. Family CORVIDÆ: Crows, Jays, etc.

FIG. 266. — European Jackdaw (*Corvus monedula*.) (From Dixon.)

Cultrirostral Oscines with 10 *primaries.* — A rather large and important family, comprising such familiar birds as ravens, crows, rooks, jackdaws, magpies, jays, with their allies, and a few diverging forms not so well known; nearly related to the famous birds of paradise. There are 10 primaries, of which the 1st is short, generally about half as long as the 2d, and several outer ones are more or less sinuate-attenuate on the inner web toward the end. The tail has 12 rectrices, as usual among higher birds; it varies much in shape, but is generally rounded — sometimes extremely graduated, as in the magpie; and is not forked in any of our forms. The tarsus has scutella in front, separated on one or both sides from the rest of the tarsal envelope by a groove, sometimes naked, sometimes filled in by small scales. The bill is stout, about as long as the head or shorter, tapering, rather acute, generally notched, with convex culmen; it lacks the commissural angulation of the *Fringillidæ* and *Icteridæ*, the deep cleavage of the *Hirundinidæ*, the slenderness of the *Certhiidæ*, *Sittidæ*, and most small insectivorous birds. The rictus usually has a few stiffish bristles, and there are others about the base of the bill. An essential character is seen in the dense covering of the nostrils with large long tufts of close-pressed antrorse bristly feathers (excepting, among our forms, in *Gymnocitta* and *Psilorhinus*). These last features distinguish the *Corvidæ* from all our other birds excepting *Paridæ;* the mutual resemblance is here so close, that I cannot point out any obvious technical character of external form to distinguish, for example, *Cyanocitta* from *Lophophanes*, or *Perisoreus* from *Parus*. But as already remarked, *size* is here perfectly distinctive, all the *Corvidæ* being much larger birds than any of the *Paridæ*.

Owing to the uniformity of color in the leading groups of the family, and an apparent plasticity of organization in many forms, the number of species is difficult to determine, and is very variously estimated by different writers. Mr. G. R. Gray admits upwards of 200, which he distributes in 50 genera and subgenera; but these figures are certainly excessive.

probably requiring reduction by at least one-third, in both cases. The *Corvidæ* have been divided into five subfamilies; three of these are small and apparently specialized groups confined to the Old World, where they are represented most largely in the Australian and Indian regions; the other two, constituting the great bulk of the family, are more nearly cosmopolitan. These are the *Corvinæ* and *Garrulinæ*, or crows and jays, readily distinguishable, at least so far as our forms are concerned, by the longer pointed wings and shorter less rounded tail of the former as contrasted with the shorter rounded wings and longer more rounded or graduated tail of the latter.

26. Subfamily CORVINÆ: Crows.

FIG. 267. — Typical Corvine bill.

With the wings long and pointed, much exceeding the tail; the tip formed by the 3d, 4th, and 5th quills; 2d much shorter, 1st only about ½ as long as 3d. The legs stout, fitted for walking as well as perching. As a rule, the plumage is sombre or at least unvariegated, — blue, the characteristic color of the jays, being here rare. The sexes are alike, and the changes of plumage slight. Although technically oscine, corvine birds are highly unmusical; the voice of the larger kinds is raucous, that of the smaller strident, — witness the croak of the raven, the "caw" of the crow, the screaming of jays. They frequent all situations, and walk firmly and easily on the ground, where jays hop. They are among the most nearly omnivorous of birds, and as a consequence, in connection with their hardy nature, they are rarely if ever truly migratory. Their nesting is various, according to circumstances, but the fabric is usually rude and bulky; the eggs, of the average oscine number, are commonly bluish or greenish, speckled. Although not properly gregarious, as a rule, they often associate in large numbers, drawn together by community of interest. In illustration of this may be instanced the extensive roosting-places in the Atlantic States, comparable to the rookeries of Europe, whither immense troops of crows resort nightly, often from great distances, recalling the fine line of the poet, —

"The blackening trains of crows to their repose."

Our three genera of *Corvinæ* are readily known by the black color of *Corvus*, the gray, white, and black of *Picicorvus*, and the blue of *Gymnocitta*. In the latter, as in *Psilorhinus* of *Garrulinæ*, the nostrils are exposed, contrary to the rule in each subfamily.

106. **COR'VUS**. (Lat. *corvus*, a crow. Fig. 267.) RAVENS. CROWS. The species throughout uniform lustrous black, including the bill and feet; nasal bristles about half as long as the bill, which exhibits the typical cultrirostral style. Nostrils large, but entirely concealed. Wings much longer than tail, folding about to its end. Several outer primaries sinuate-attenuate on inner webs. Tail rounded, with broad feathers, sinuate-truncate at ends, with mucronate shafts. Feet stout; tarsus more or less nearly equal to middle toe and claw, roughly scutellate in front, laminar behind, with a set of small plates between.

Analysis of Species.

Ravens, with the throat-feathers acute, lengthened, disconnected.

About 2 feet long; wing 16–18 inches; tail about 10. Bases of cervical feathers gray . . . . *corax* 338

Smaller; concealed *bases* of cervical feathers pure white (Southwestern) . . . . . *cryptoleucus* 339

Crows, with the throat-feathers oval and blended.

Length 18–20; wing 12–14; tail 7–8; bill 1¾–2, its height at base ⅔; tarsus about equal to the middle toe and claw, longer than bill; 1st quill not longer than 10th . . . . . *frugivorus* 340, 341

Small. Length 14–16: wing 10-11: tail 6-7: bill 1¾-2: tarsus rather longer than bill or middle toe and claw; 1st quill longer than 10th. (Northwestern) . . . . . *caurinus* 342

Small; 14-16 inches long; wing 10–11; tail 6–7; tarsus shorter than middle toe and claw, longer than bill; 1st quill not longer than 10th . . . . . *maritimus* 343

338. **C. co'rax.** (Gr. κόραξ, *korax*, Lat. *corax*, a croaker — the raven. Fig. 268.) AMERICAN RAVEN. Feathers of throat somewhat stiffened, lengthened, pointed, lying loose from one another; those of neck with gray downy bases, as elsewhere on the body. Color entirely lustrous black, with chiefly purplish and violet burnishing. Length about 2 feet — at least over 20 inches; expanse of wings 4 or 4½ feet — much over a yard. Wing about 1½ feet — at least over 15 inches. Tail about 10 inches; its feathers graduated 1.50–2.50 inches. Bill along chord of culmen, and tarsus, about 2.50. Varies much in size. Greenland and Labrador specimens are of great size, with immense bill touching 3.00. The bill is usually longer and relatively less deep in the American than in the European raven; whole bird more sturdy and robust. The usual wing-formula is: primary $4>3=5>2>6>1=8$; but these quills grow and moult so gradually the proportionate lengths differ much in specimens examined. The ♀ is undistinguishable from the ♂, though averaging smaller. N. Amer.; but now rare in the U. S. east of the Mississippi, and altogether wanting in most of the States; Labrador, ranging southward,

FIG. 268.—Head of a very large American Raven, nat. size. (Ad nat. del. E. C.)

rarely, along the coast to the Middle districts; very abundant in the West, where the sable plume and the bleaching skeleton, the ominous croak and the Indian war-whoop, are not yet things of the past. Wherever in the West the raven abounds, the crow seems to be supplanted. Nests high in trees and on cliffs, selecting the most inaccessible places. Eggs 4–8, oftener 4–5, about 2.00 × 1.30, greenish, dotted, blotched and clouded with neutral tints, purplish- and blackish-browns.

339. **C. cryptoleu'cus.** (Gr. κρυπτός, *kruptos*, crypted or hidden: λευκός, *leukos*, white.) WHITE-NECKED RAVEN. Throat-feathers as in *C. corax;* but bases of the feathers of neck snowy-white. Smaller than the raven; about as large as a good-sized crow, and generally taken for one in those regions where it occurs with the raven, the difference between them being obvious in life: the accounts of "crows" in some regions where *C. americanus* does *not* occur being based upon the presence of *C. cryptoleucus*. Southwestern U. S., Llano Estacado and higher Rio Grande of Texas, Wyoming, Colorado, New Mexico, Arizona, and portions of California.

340. **C. frugi'vorus.** (Lat. *frugivorus*, fruit-eating: *frux*, fruit; *voro*, I devour.) COMMON AMERICAN CROW. The common crow is a foot and a half long, or rather more; wing 12 to 14 inches; tail 7 to 8; bill 1.75–2.00, about 0.75 high at base; tarsus about equal to middle toe and claw, rather exceeding the bill. First primary not longer than 10th. Feathers of the throat oval, soft, and blended; no snowy-white under-plumage. The burnishing is chiefly on the wings, tail, and back, the head being nearly dead-black. The ♀ is decidedly smaller than the ♂, and under-sized cabinet specimens are not seldom labelled "ossifragus." Eastern N. Amer., chiefly U. S., not ordinarily found westward in the interior, where the raven abounds; rare or wanting in the Upper Missouri and Southern Rocky Mt. regions; common, however, in some parts of California. In settled parts of the country the crow tends to colonize, and some of its "roosts" are of vast extent. Mine is on the Virginia side of the Potomac, near Washington. Crows are always flying west over the city in the afternoon, and when as a boy I used to see the gray of the morning, crows were flying the other way. It is doubtless the same now; but I oftener hear midnight migrants than see such "early birds" these days. Nest in trees, anywhere in the woods, usually concealed with some art, though so bulky; built of sticks and trash; eggs 4–6–7, 1.60 × 1.20, like the raven's in color and markings, and equally variable. (*C. americanus*, Auct.)

341. **C. f. flori'da/nus.** (Lat. of Florida.) FLORIDA CROW. Represents the greater relative size of the bill and feet shown by many resident birds of Florida and corresponding latitudes.

342. **C. cauri'nus.** (Lat. *caurus*, the N. W. wind, whence *caurinus*, northwestern.) NORTHWESTERN FISH CROW. Small: about the size of the common fish crow, but feet more as in *C. americanus*, the tarsus not being shorter than the middle toe and claw, though rather less than the bill; 1st primary longer than 10th. Length 14.00–16.00; wing 10.50; tail 6.50; bill 1.75–2.00. N. Pacific coast, Oregon to Alaska; maritime; piscivorous; voice said to be different from that of *C. frugivorus*.

343. **C. mari'timus.** (Lat. *maritimus*, maritime; *mare*, the sea.) SOUTH-EASTERN FISH CROW. Small. Length 14.00–16.00; wing 10.00–11.00; tail 6.00–7.00; bill 1.50; tarsus 1.60; middle toe and claw 1.75. First primary not longer than 10th; a bare space about the gape? South Atlantic and Gulf States, N. to New England. Common; maritime, piscivorous. Apparently a different bird from any of the foregoing, as it presents some tangible distinctions, although constantly associated with *C. frugivorus*. Nest and eggs not to be distinguished with certainty from those of the common crow, though averaging smaller. (*C. ossifragus* Wils.)

107. **PICICOR'VUS.** (Compounded of *picus*, a woodpecker, or *pica*, a magpie, and *corvus*, a crow. Fig. 269.) AMERICAN NUTCRACKERS. General characters of the European *Nucifraga*. Bill slenderer, more acute, with more regularly curved culmen and commissure, and straight instead of convex and ascending gonys; as a whole somewhat decurved. Nostrils circular, concealed by a full tuft of plumules. Wings long and pointed, folding to the end of the tail; 5th quill longest; 4th, 3d, 6th little less; 2d much shorter, 1st not half as long as 5th. Tail little over half as long as wing, little rounded. Tarsus shorter than middle toe and claw; the envelope divided into small plates on the sides behind toward the bottom. Claws very large, strong,

FIG. 269. — Head of *Picicorvus*, nat. size. (Ad nat. del. E. C.)

acute and much curved, especially that of the hind toe; the lateral reaching beyond base of the middle claw. Coloration peculiar; gray, with black-and-white wings and tail. Habits much the same as those of *Nucifraga;* alpine and sub-boreal, piniceline, and pinivorous. One species, confined to W. Amer.

344. P. columbia'nus. (Of the Columbia River. Fig. 270.) CLARKE'S CROW. ♂♀, adult: Gray, often bleaching on the head; wings glossy black, most of the secondaries broadly tipped with white; tail white, including the under coverts; the central feathers and usually part of the next pair, together with the upper coverts, black. Bill and feet black. Iris brown. Length about 12.50; extent 22.00; wing 7.00–8.00; tail 4.00–5.00; tarsus 1.35; bill averaging 1.67; feet from 1.25 to 1.75. Sexes alike in color, but ♀ smaller than ♂. Young similar, but browner ash. There is great difference in the shade in adults, the plumage when fresh being more glaucous-ash, wearing browner, and also bleaching in patches, especially on head. Coniferous belt of the West, N. to Sitka, S. to Mexico, E. to Nebraska, W. to the Coast Ranges; the American representative of the European nutcracker, *Nucifraga caryocatactes;* abundant, imperfectly gregarious. A remarkable bird, wild, restless, and noisy, sometimes congregating by thousands in the pineries of the W., roving in search of food. Breeds high in pines, in alpine and northerly localities, concealing the nest with care; nest of sticks as a basis, on which bark-strips, grasses, and other fibrous substances are well matted together. Eggs 1.20 × 0.90, light grayish-green, speckled and blotched with grayish-brown and lilac, chiefly about the larger end.

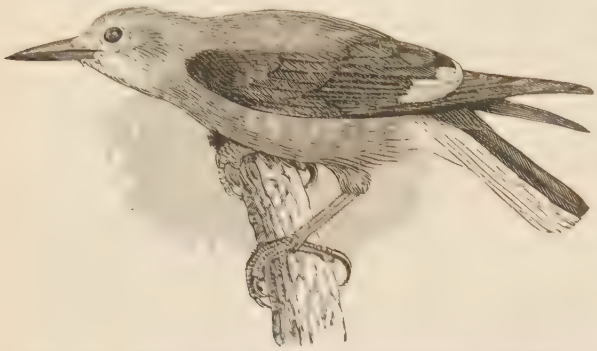


FIG. 270. — Clarke's Crow, reduced. (Sheppard del. Nichols sc.)

108. GYMNOCIT'TA. (Gr. *γυμνός, gumnos,* naked, as the nostrils are; *κίττα, kitta,* a jay.) BLUE CROWS. Bill of peculiar shape, with nearly straight culmen mounting on forehead, thus somewhat as in *Sturnella,* between the prominent and somewhat antrorse antiæ, which, however, do not hide the nostrils; slender, tapering, acute, not notched; gonys straightish, scarcely ascending. Nostrils small, oval, entirely exposed. Tail nearly square, much shorter than wings. Wings long, pointed, folding nearly to end of tail; 4th primary longest, 3d and 5th scarcely shorter; 2d shorter, 1st shorter still. Feet stout, indicating somewhat terrestrial habits: tarsus longer than middle toe without claw, the envelope subdivided behind towards the bottom. Claws all large, strong, and much curved. Color bluish, nearly uniform: sexes alike. One species.

FIG. 271. — Blue Crow, nat. size; culmen too convex. (Ad nat. del. E.C.)

345. G. cyanoce'phala. (Gr. *κύανος, kuanos,* blue; *κεφαλή, kephalē,* head. Fig. 271.) BLUE CROW. ♂: Dull blue, very variable in intensity, nearly uniform, but brightest on head, fading

on belly; the throat with whitish streaks; wings dusky on the inner webs. Bill and feet black. Iris brown. Length 11.00–12.00; extent 16.50–19.00; wing 5.50–6.00; tail about 4.50; bill 1.33, but from 1.25–1.50; ♀ smaller, duller. Rocky Mt. region; much the same elevated distribution as the last, but apparently rather more southerly; decidedly gregarious, and very abundant in some places. A remarkable bird, combining the form of a crow with the color and habits of a jay, and a peculiarly shaped bill. It roves about in noisy restless flocks, sometimes of thousands, in search of food, which is pine seeds, especially piñones, juniper berries, acorns, etc. Breeds in colonies; nest in piñon pines and other evergreens, compact but bulky, of twigs, and fibrous bark-strips well worked together; eggs 3–4, 1.25 × 0.87, greenish-white, profusely spotted with light brown and purplish; laid in April.

27. Subfamily GARRULINÆ: Jays.

FIG. 272. — European Jay (*Garrulus glandarius*). (From Dixon.)

With the wings much shorter than or about equalling the tail, both rounded; tip of the wing formed by the 4th–7th quills. The feet, as well as the bill, are usually weaker than in the true crows, and the birds are more strictly arboricole, usually advancing by leaps when on the ground, to which they do not habitually resort. In striking contrast to most *Corvinæ*, the jays are usually birds of bright and varied colors, among which blue is the most prominent; and the head is frequently crested. The sexes are nearly alike, and the changes of plumage do not appear to be as great as is usual among highly-colored birds, although some differences are frequently observable. Our well-known Blue Jay is a familiar illustration of the habits and traits of the species in general. They are found in most parts of the world, and reach their highest development in the warmer portions of America. With one boreal exception (*Perisoreus*), the genera of the Old and New World are entirely different.

It is proper to observe, that, while the American *Corvinæ* and *Garrulinæ*, upon which the foregoing paragraphs are mainly drawn up, are readily distinguishable, the characters given may require modification in their application to the whole family, the different divisions of which appear to intergrade closely. Our six genera are easily discriminated.

Analysis of Genera.

Nostrils large, naked.
- Not crested. General color brown . . . . . *Psilorhinus* 109

Nostrils moderate, covered by feathers.
- First primary attenuated, falcate: tail exceedingly long, graduated.
  - Not crested. Colors black, white, and iridescent . . . . . *Pica* 110
- First primary not attenuated. Tail moderate.
  - Crested. Blue: wings and tail barred with black . . . . . *Cyanocitta* 111
  - Not crested. Blue: wings and tail unbarred . . . . . *Aphelocoma* 112
  - Green and yellow, with blue and black on head . . . . . *Xanthura* 113
  - Gray, with slaty wings and tail . . . . . *Perisoreus* 114

109. **PSILORHI'NUS**. (Gr. ψιλός, *psilos*, smooth, bare, bald; ῥίς, ῥινός, *hris, hrinos*, nose.) BROWN JAYS. SMOKY PIES. Nostrils exposed, large, rounded. Bill stout, with very convex culmen, curved from the base. Wings and tail of about equal lengths, both rounded. Of large size, and smoky-brown color; not crested.

346. **P. mo'rio**. (Lat. *morio*, "a dark brown gem.") BROWN JAY. Smoky-brown, darker on head, fading on belly; wings and tail with bluish gloss. Bill and feet black, sometimes yel-

low. Length about 16.00; wing and tail about 8.00, the graduation of the latter about 2.00; bill 1.25. Rio Grande Valley and southward.

110. **PICA.** (Lat. *pica*, a pie.) MAGPIES. Tail extremely long, when fully developed forming more than ½ the total length, graduated for about ½ its own length; the feathers with rounded ends, the middle pair at least tapering, and specially lengthened beyond the rest. Bill of ordinary corvine shape; nostrils concealed by long nasal tufts. Wings short and rounded, with very short, narrow, falcate first primary. Feet stout; tarsus little longer than middle toe and claw. Head not crested. A naked space about eye. Plumage black, iridescent, with masses of white; bill black or yellow. Sexes alike. Habits arboreal and somewhat terrestrial, — very irregular, in fact, a magpie's general character being none of the best, though the generic characters are excellent.

FIG. 273. — Magpie, reduced. (From Dixon.)

347. **P. rus'tica hudson'ica.** (Lat. *rustica*, rustic, rural; *rus, ruris*, the country. Of Hudson's Bay. Fig. 273.) MAGPIE. Lustrous black, with green, purple, violet, and even golden iridescence, especially on the tail and wings. Below, from the breast to the crissum, a scapular patch, and a great part of the inner webs of the primary quills, white; some whitish touches on the throat; lower back showing gray, owing to mixture of white with black; bill and feet black; eyes blackish. Length 15 or 20 inches, according to the development of the tail, which is a foot or less long, extremely graduated; extent about 2 feet; wing about 8.00, the outer primary short, slender, and falcate; bill 1.25; tarsus 1.67; middle toe and claw 1.50. ♀ rather smaller than ♂, but alike in color. Arctic Amer. and U. S. from Plains to Pacific, except California; common. The American magpie is extremely similar to the notorious bird of Europe, and attempts to establish specific characters have failed. It is a rather larger and "better" bird, though quite

as much of a rascal. The nest is placed in thick shrubbery, as big as a bushel, bristling with a *chevaux-de-frise* outside, with a lateral covered way leading to the nest within. Eggs 6–9, 1.20 to 1.40 long by 0.90 to 1.00 broad, pale drab, dotted, dashed, and blotched with purplish-brown.

348. P. nut'talli. (To Thos. Nuttall.) YELLOW-BILLED MAGPIE. Bill and naked space about eye yellow. Otherwise, precisely like the last, of which it is a perpetuated accident! The European magpie sometimes shows the same thing, and in some other species, like *P. morio*, the bill is indifferently black or yellow. California, common.

111. CYANOCITTA. (Gr. *κύανος, kuanos*, blue; *κίττα, kitta*, a jay.) CRESTED BLUE JAYS. Conspicuously crested; wings and tail blue, black-barred; bill and feet black. Length 11.00–12.00; wing or tail 5.00–6.00. Nostrils large, subcircular, but concealed. Wings and tail of equal lengths, both rounded. Hind claw large, equalling or exceeding its digit in length. There are two species of this beautiful genus, one light blue and white, Eastern, standing quite alone; the other dusky-bodied, Western, running into several varieties.

Analysis of Species and Varieties.

Purplish-blue, whitening below, with a black collar . . . . . *cristata* 349
Sooty-brownish or -blackish, bluing on body behind, wings and tail; the latter black-barred.
  Sooty-blackish; little if any blue on forehead; none about eye; wing-coverts unbarred . . *stelleri* 350
  Sooty-blackish; but blue on forehead and above eye; wing-coverts unbarred . . . . . *annectens* 351
  Sooty-brownish, blue on forehead; little if any blue about eye; wing-coverts unbarred . . *frontalis* 353
  Sooty-brownish, the crest quite black. Bluish-white streaks on forehead and about eye; wing-coverts black-barred . . . . . *macrolopha* 352

349. C. crista'ta. (Lat. *cristata*, crested. Fig. 274.) BLUE JAY. ♂: Purplish-blue, below pale purplish-gray, whitening on throat, belly, and crissum. A black collar across lower throat and up the sides of the neck and head behind the crest; a black frontlet bordered with whitish. Wings and tail pure rich blue, with black bars, the greater coverts, secondaries, and tail-feathers, except the central, broadly tipped with pure white; tail much rounded, the graduation over an inch. Length 11.00–12.00; extent 16.00–17.50; wing and tail, each, 5.00–6.00; bill 1.25; tarsus 1.35. ♀ similar, not so richly blue: smaller. There is much difference in size between northern and southern bred birds, as in the *Agelæus*. Florida specimens are particularly small, the bill relatively larger, the crest less, the white on wings and tail restricted; as worthy as some other Floridan races to be named (*C. c. florincola*, N.). Eastern N. A., especially U. S., but N. to Hudson's Bay; W. to the central plains; a very abundant resident or half-migratory bird, breeding throughout its range; a well-known character! Nest in trees and bushes, or any odd nook, large and substantial; eggs 5–6 in number, 1.00 to 1.20 long by 0.80 to 0.90 broad, drab-colored with brown spots.

FIG. 274. — Blue Jay, reduced. (Sheppard del. Nichols sc.)

350. C. stel'leri. (To G. W. Steller.) STELLER'S JAY. ♂ ♀: Whole head, neck, and back sooty blackish, little if any lighter on throat, and with little if any blue on forehead or about eyes;

this sooty color passing insensibly on the rump and breast into dull blue. Wings and tail richer blue, crossed with numerous black bars, not on the secondary coverts. Bill and feet black. Young more fuliginous, the wing-bars faint if not wanting. Size of the Eastern jay, or rather larger. Pacific coast region, Oregon to Alaska, E. to the Rocky Mts., where inosculating with *C. s. macrolopha*. This is the typical form, with little or no blue, no whitish on head, and unbarred wing-coverts; running through *annectens*, *frontalis*, and *macrolopha* into some very different Mexican forms. Habits, nest, and eggs as described under *macrolopha*.

351. C. s. annec'tens. (Lat. *annectens*, annexing.) BLACK-HEADED JAY. This name has been given to specimens directly connecting *stelleri* and *macrolopha*. General tone of the former; quite blackish, short-crested, with plain wing-coverts; but blue frontal streaks and whitish eye-patch of the latter. N. Rocky Mts., U. S.

353 C. s. fronta'lis. (Lat. *frontalis*, pertaining to *frons*, the forehead.) BLUE-FRONTED JAY. SIERRA JAY. An offset from *stelleri*; the sooty color rather brownish than blackish; the blue of different shade on body from the deep indigo on wings and tail; whole crest glossed with bluish, and conspicuous blue streaks on forehead; no whitish eye-patches; wing-coverts obsoletely or not barred. Sierras Nevadas of California.

352. C. s. macro'lopha. (Gr. μακρός, *makros*, long; λόφος, *lophos*, crest. Fig. 275.) LONG-CRESTED JAY. Better marked than the connecting links. ♂♀: Upper parts sooty umber-brown, with a faint blue tinge, blackening on head and neck all around in decided contrast, passing on rump and upper tail-coverts into beautiful light cobalt-blue; passing on fore breast into the same blue which occupies all the under parts. Crest black, but faced on forehead with bluish-white, which, when the feathers are not disturbed, runs in two parallel lines from the nostrils upward — these colored tips of the feathers of firmer texture than their basal portions. One or both eyelids patched with white. Chin abruptly whitish, streaky. Exposed surfaces of wings rich indigo-blue, most intense on the inner secondaries, which, with the greater coverts, are regularly and firmly barred across both webs with black; the outer webs of the primaries lighter blue, more like that of the rump or under parts. Upper surface of tail rich indigo, like the secondaries, and similarly black-barred; these bands most distinct towards the ends and on the outer webs of the feathers: tail viewed from below appearing mostly blackish. Iris dark. Bill and feet black. Length 12.00–13.00; extent 17.00–19.00; wing 5.50–6.50; tail the same; bill 1.12; tarsus 1.50; middle toe and claw 1.33. Sexes quite alike, but ♀ at the lesser dimensions given. Crest longer than in northern *stelleri*, sometimes 3.00. Young: Much more sooty; below entirely fuliginous, with the future blue indicated by an ashy or grayish shade. Wings and tail nearly as bright blue as in the adult, but the black bars faint or wanting. Crest shorter, not quite black, not faced with blue, and no white about eyes. This form melts into *C. diademata* of Mexico, which is bluer; and this is near the quite blue *C. coronata*. Rocky Mt. region, U. S., especially southerly; a common bird of the pine belt, displaying in marked degree the notorious attributes of its genus, or genius. Nest in trees and bushes, usually concealed with art, though bulky

FIG. 275. — Long-crested Jay, nat. size. (Ad nat. del. E. C.)

eggs 5–6. 1.25 to 1.35 × 0.80 to 0.90, pale bluish-green, profusely spotted and blotched with dark olive-brown and lighter brown.

112. **APHELOCOMA.** (Gr. *ἀφελής, apheles*, smooth, sleek; *κόμη, kome*, hair: alluding to the lack of crest.) CRESTLESS BLUE JAYS. Generally as in *Cyanocitta*. Head uncrested. Tail longer or shorter than wings, instead of about equal, graduated (in some extralimital forms about equal to the wing and even). Tarsus rather longer than middle toe and claw. Wings and tail blue, without black bars, and blue the chief body-color; whitish underneath, with (usually) or without a gray patch on the back. All Southern and Southwestern.

Analysis of Species and Varieties.

Tail longer than wings, graduated. Above blue, with gray dorsal area; belly dingy whitish; a superciliary stripe, and the throat streaky.
- Forehead hoary-white; superciliary stripe not well-defined. Dorsal patch well-defined. Crissum blue, contrasting with grayish under parts . . . . . *floridana* 354
- Forehead blue; superciliary stripe distinct. Dorsal patch ill-defined, spreading and bluish. Crissum bluish, but not well contrasted with dingy under parts . . . . . *woodhousii* 355
- Forehead blue; superciliary stripe distinct. Dorsal patch well-defined. Crissum whitish like other under parts . . . . . *californica* 356

Tail rather shorter than wing, rounded. Blue, without definite dorsal area, or pectoral or superciliary streaks . . . . . *arizonæ* 357

354. **A. florida'na.** (Of Florida.) FLORIDA JAY. ♂ ♀: Blue; back with a small well-defined gray patch not invading scapulars; belly and sides pale grayish; under tail-coverts and tibiæ blue in marked contrast; much hoary whitish on forehead and sides of crown, but no sharp white superciliary stripe; chin, throat, and middle of breast vague streaky whitish and bluish; ear-coverts dusky; the blue that seems to encircle the head and neck well defined against the gray of back and breast. Bill comparatively short, very stout at the base. Length 11.00–12.50, average 11.75; extent 13.50–15.00, average 14.50; wing 4.00–4.75, average 4.40; tail 4.50–5.50, average 5.00, always longer than wing; bill about 1.00. Florida (and Gulf States?), abundant. Very local, and not authentic as occurring outside of Florida. Usual habits of jays. Nest a flat structure, in bushes, of twigs lined with fibres. Eggs 4–5, bluish-green, sparingly speckled, chiefly at larger end, with brown, 1.00 × 0.80.

355. **A. f. woodhou'sii.** (To S. W. Woodhouse.) WOODHOUSE'S JAY. The dorsal patch dark, glossed with blue, shading into the blue of surrounding parts; under parts rather darker than in *C. floridana*, somewhat bluish-gray; the under tail-coverts bluish but not contrasted; on the breast the blue and gray shading into each other, the gular and pectoral streaks whitish and well-defined, the superciliary line definite white, but no hoary on forehead; bill slenderer. ♂ ♀, adult: General color blue, rich and pure on the wings, tail, rump, crown, back and sides of neck, and on the breast surrounding the streaky white area. Middle of back and scapulars dark gray much tinged with blue, shading insensibly into the surrounding blue. Upper and under tail-coverts blue. Under parts from the breast gray, with blue tinge (in *californica* nearly white). Chin, throat, and breast with a series of whitish blue-edged streaks, enclosed in surrounding blue. Lores, orbits, and auriculars dusky. A series of sharp white streaks over and behind eye. Wings and tail blue; the inner webs of most of the quills, and the tail viewed from below, dusky. The inner secondaries and tail-feathers, closely examined, show obsolete barring, like that which becomes pronounced in *Cyanocitta*, but the traces are faint, and the feathers may be properly called plain. Iris brown; bill and feet black. Length of ♂, about 12.00: extent 16.50; wing 5.00; tail 6.00; bill 1.12; tarsus 1.50; middle toe and claw 1.33. ♀ smaller: average 11.25; extent 15.50, etc. Young: Wings and tail as in the adult; upper parts mostly gray: under parts grayish-white, with little or no blue on the breast, the pectoral streaks undefined, as are those over the eye. Rocky Mt. region, from Wyoming and Idaho southward. Habits, nest and eggs as in other species. The eggs in this genus usually differ from those of *Cyanocitta*, by more greenish ground color and bolder marking, especially

at the larger end. In regions where Woodhouse's and the long-crested jays occur together, the latter lives chiefly in the pines, the former in the scrub-oak and other thickets.

356. A. f. californ'ica. (Of California.) CALIFORNIA JAY. The dorsal patch light and distinct as in *A. floridana*, but the under parts, including tail-coverts and tibiæ, nearly white; gular streaks very large, aggregated, and white, causing the throat to be nearly uniform; a white superciliary line, as in *woodhousii*, but no hoary on forehead; bill slender. Thus it is seen that each of the three forms presents a varying emphasis of common characters. ♂ ♀, adult: General color blue. Scapulars and interscapulars gray, with little if any tinge of blue; rump and upper tail-coverts bluish-gray, usually mixed with some white. Forehead and nasal tufts blue like crown; a sharp white superciliary stripe over and behind eye; lores, eyelids, and auriculars blackish. Under parts from the breast soiled white, with little or no tinge of blue except on crissum; breast appearing as if blue, overlaid with broad white stripes, which become continuous on throat and chin; the breast is really white, in streaks edged with blue, and with a surrounding of blue in which the streaks are as if framed. Iris brown; bill and feet black. Length 12.00 or less; wing 5.00; tail 5.50; bill 1.00; tarsus 1.50; middle toe and claw 1.25. In comparison with *woodhousii*, differences are seen in the well-defined gray dorsal patch; the nearly white underparts without decidedly blue crissum; and the broader and more continuously white gular streaks. The general habits, nest, and eggs are the same.

357. A. ultramari'na arizo'næ. (Lat. *ultramarina*, beyond the sea, name of a blue color.) ARIZONA JAY. Belonging to a different section of the genus, distinguished by having the tail rather shorter than longer than the wings, the upper parts uniform blue, and no throat-streaks. ♂ ♀, adult: Above, light blue, purer on head, wings, and tail than on back, where rather dull. Beneath, sordid bluish-gray, bluest on breast, paler on throat, whitening on belly, flanks, and crissum. Lores blackish; orbits and auriculars dark. No superciliary stripe, nor decided streaks on throat or breast. Bill normally black, sometimes irregularly patched with whitish. Feet black. Length about 13.00; wing 6.25–6.75; tail 6.00–6.50, rounded, the lateral feathers graduated about 0.50; bill 1.25, 0.40 deep at base; tarsus 1.67; middle toe and claw 1.33. Young: Little if any blue excepting on wings and tail, being dull gray above; below, much like the adult. Bill flesh-colored on most of under mandible. Arizona, and probably New Mexico; N. to about 35°. (*C. sordida*, Bd., 1858; Coues, 1872, may be a variety of *sordida*, but it is probably going too far to bring in *ultramarina*, and make both this and *arizonæ* varieties of *sordida*.)

113. XANTHU'RA. (Gr. *ξανθός*, *xanthos*, yellow; *οὐρα*, *oura*, tail.) GREEN JAYS. No crest. Wings short, much rounded, with lengthened inner secondaries folding nearly over the primaries. Tail longer than wings, graduated. Bill short and deep, with culmen curved from the base. Colors green and yellow, with black and blue on head. Several tropical species of these luxurious jays, one reaching our border.

358. X. luxurio'sa. (Lat. *luxuriosa*, luxurious. Commonly written *luxuosa*.) RIO GRANDE JAY. Adult ♂: Back and exposed surface of wings yellowish-green; inner webs of most of the quills blackish edged with clear yellow; their shafts black above, yellow or whitish below; lining of wings clear yellow. Four middle tail-feathers greenish-blue, at base little different from back, bluing toward ends; these feathers, seen from below, quite black; other tail-feathers all clear rich yellow, including their shafts. Under parts from the breast light greenish-yellow, yielding to pure yellow on middle of belly. Top of head and nasal plumules beautiful rich blue, yielding on forehead to hoary-white. Sides of head to above eyes, and whole chin, throat, and fore-breast jet black, enclosing a large triangular patch of blue on the side of the lower jaw, and blue touches on the eyelids. Bill and feet black. Length 11.25–12.00; extent 14.50–15.50; wing 4.50–5.00; tail 5.25–5.75; tarsus 1.50; middle toe and claw 1.25; bill 1.00, very stout. ♀ near the lesser of the dimensions given. This truly elegant bird is abundant in some localities in the Lower Rio Grande valley. Nest in bushes

and small trees, bulky, of twigs with finer lining; eggs usually 3–4, 1.10 × 0.80, greenish-drab, marked as usual with browns.

114. PERISO'REUS. (Gr. *περισωρεύω, perisoreuo,* I heap up; probably in allusion to the hoarding or thievish propensities of jays.) GRAY JAYS. Not crested. Plumage soft, full and lax, grayish or sooty. Bill very short, not deep but wide at base; culmen little curved; gonys ascending. Wings and tail of approximately equal lengths; latter graduated. A circumpolar and boreal or alpine genus, of one species in America, with several varieties.

Analysis of Varieties.

Dark hood moderate; forehead white; back brownish-gray, streaked	*canadensis*	359
Dark hood extensive; forehead smoky; back brownish-gray, unstreaked	*fumifrons*	360
Dark hood extensive; forehead whitish; back brownish, with white shaft-lines	*obscurus*	361
Dark hood restricted; forehead extensively white; back ashy-gray, unstreaked	*capitalis*	362

359. P. canaden'sis. (Of Canada. Fig. 276.) CANADA JAY. WHISKEY JACK. MOOSE BIRD. Gray, whitening on head, neck, and breast; a dark cap on hind head and nape, separated by a gray cervical collar from the ashy-plumbeous back; wings and tail plumbeous, the feathers obscurely tipped with whitish. Bill and feet black. Young: Much darker, sooty or smoky-brown; the bleaching progresses indefinitely with age. Length 10.00–11.00; extent about 16.00; wing 5.25–5.75; tail rather more, graduated; tarsus 1.33; bill under 1, shaped like a titmouse's. Arctic Am. into the N. States, N. W. to Alaska; breeds in Maine and northward; resident, and seldom seen south of its breeding range. The "Wisskachon" (whence "whiskey John" and then "whiskey Jack") is noted for the familiarity and impudence with which it hangs about the hunter's camp to steal provisions, for consorting with moose, and for nesting in winter or early spring. Nest usually on the bough of a spruce or other conifer, a large substantial structure, of twigs, grasses, mosses, and feathers; eggs 3–4, 1.20 × 0.85, yellowish-gray to pale green, finely dotted and blotched with brown and slate, or lavender, especially about the larger end; others more uniformly and largely blotched; variation wide, as in other jays.

FIG. 276. — Canada Jay, reduced. (Sheppard del. Nichols sc.)

360. P. c. fu'mifrons. (Lat. *fumus,* smoke; *frons,* forehead.) ALASKAN JAY. SMUTTY-NOSED JAY. Similar: coloration darker and dingier throughout; white of forehead obscured or obliterated by smoky-gray. Coast region of Alaska.

361. P. c. obscu'rus. (Lat. *obscurus,* obscure.) OREGON JAY. More different: dark hood encroaching on crown, not well defined; upper parts umber-brownish rather than plumbeous, the feathers with white shaft-lines; tail not distinctly tipped with whitish. Pacific coast region, Oregon to Sitka.

362. P. c. capita'lis. (Lat. *capitalis,* capital, relating to the head, *caput.*) ROCKY MOUNTAIN JAY. General color ashy-plumbeous, or leaden-gray, paler below; wings and tail blackish, with a peculiar glaucous shade, as if frosted or silvered over. The body-color giving way on the breast and neck to whitish, established as hoary-white on the head, isolating the narrow well-defined nuchal band of sooty-gray. No white lines on back; tail-feathers distinctly tipped with whitish, and much edging of the same on the wings. The clearer colors generally — back rather bluish-gray than brownish-gray, very white head with narrow nuchal band — produce

a bird differing visibly from the ordinary gray jay. The changes of plumage with age are parallel. Size at a maximum. Length about 12.00; extent 17.00; wing and tail, each, near 6.00; bill 0.75; tarsus 1.30; middle toe and claw 1.00. S. Rocky Mt. region, especially Colorado, Wyoming, N. New Mexico and Arizona, Idaho and Montana, northward shading into typical *canadensis*. The high mountains of Colorado furnish the extreme cases.

19. Family STURNIDÆ: Old World Starlings.

Fig. 277. — The Starling. (From Dixon.)

A family confined to the Old World: difficult to characterize, owing to the variety of forms it includes. Apparently related to the *Icteridæ*, from which distinguished by the presence of *ten* primaries, the first short or quite spurious. The only form with which we have here to do is the genus *Sturnus*, belonging to the

28. Subfamily STURNINÆ: Typical Starlings.

115. **STUR'NUS.** (Lat. *sturnus*, a stare or starling.) Starlings. Bill shaped somewhat as in *Sturnella* or *Icterus*, but widened and flattened; rather shorter than head; culmen and gonys about straight, both gently rounded in transverse section, and at the tip; the culmen rising high on the forehead, dividing prominent antiæ which extend into the well-marked nasal fossæ; a conspicuous nasal scale, overarching the nostrils; tomial edges of mandibles dilated, especially those of the upper mandible; commissure obtusely angulated; sides of lower mandible extensively denuded and somewhat excavated; feathers filling the interramal space; no bristles about the bill. Wings long and pointed; 1st primary spurious and very small; 2d and 3d longest,

rest rapidly graduated. Tail of 12 feathers, emarginate, little more than half as long as the wing. Feet short; tarsus of strictly oscine podotheca, scutellate and laminiplantar, about as long as middle toe without its claw. Lateral toes of subequal lengths, their claws falling short of base of middle claw; hind claw about as long as its digit. Plumage metallic and iridescent, the feathers all distinctly outlined.

340. S. vulga'ris. (Lat. *vulgaris*, vulgar, common. Fig. 277.) The Starling. Adult: General plumage of metallic lustre, iridescing dark green on most parts, more steel-blue on the under parts, and violet or purplish-blue on the fore parts; more or less variegated throughout with pale ochraceous or whitish tips of the feathers. Wings and tail fuscous, the exposed parts of the feathers somewhat frosty or silvery, with velvety-black and pale ochrey margings, the former within the latter. Bill yellowish; feet reddish. Young and in winter: Plumage more heavily variegated throughout, with larger tawny-brown spots on the upper parts, and white ones below; wings and tail strongly edged with brown; bill dark. Length about 8.50; wing 5.00; tail 2.75; bill 1.00; tarsus 1.00; middle toe and claw 1.25. Europe, etc., one of the longest and best known of birds. Has straggled to Greenland in one known instance.

2. Suborder PASSERES MESOMYODI, OR CLAMATORES: Non-melodious or Songless Passeres.

Mesomyodian scutelliplantar Passeres with ten fully developed primaries. — Syrinx with fewer than four distinct pairs of intrinsic muscles inserted at the middle of the upper bronchial half-rings, representing the mesomyodian type of voice-organ, and constituting an uncomplicated and ineffective musical apparatus. Side and back of tarsus, as well as the front, covered with variously arranged scutella, so that there is no sharp undivided ridge behind (as, *e. g.*, in fig. 280, *a*). Ten fully developed primaries, the 1st of which, if not equalling or exceeding the 2d, is at least ⅔ as long. (See p. 240, where the *Oscines* are defined as acromyodian laminiplantar Passeres with 9 fully-developed primaries, or 10 and the 1st short or spurious.)

The essential character of this group, as distinguished from *Oscines*, is thus seen to be an anatomical one, consisting in the non-development of a singing apparatus; the vocal muscles of the lower larynx (*syrinx*) being small and few, or else forming simply a fleshy mass, not separated into particular muscles; in either case inserted in a special manner into the bronchial half-rings. This character, though subject to some uncertainty of determination, corresponds well with the principal external character assignable to the group, namely, a certain condition of the tarsal envelope rarely if ever seen in the higher *Passeres*. If the leg of a King-bird, for example, be closely examined, it will be seen covered with a row of scutella forming cylindrical plates continuously enveloping the tarsus like a segmented scroll, and showing on its postero-internal face a deep groove where the edges of the envelope come together; this groove widening into a naked space above, partially filled in behind with a row of small plates. With some minor modifications, this scutelliplantar condition marks the *Clamatorial* birds, and is something tangibly different from the typical *Oscine* or laminiplantar character of the tarsus, which consists in the presence on the sides of entire corneous laminæ meeting behind in a sharp ridge. And even when, as in the cases of the oscine *Eremophila* and *Ampelis*, there is extensive subdivision of the laminæ on the sides or behind, the arrangement does not exactly answer to the above description. The *Clamatores* represent the lower *Passeres*, approaching the large order *Picariæ* (see beyond) in the steps by which they recede from *Oscines*, yet well separated from the Picarian birds. The families composing the suborder, as commonly received, are few in number; only one of them is represented in North America, north of Mexico.

20. Family TYRANNIDÆ: American Flycatchers.

FIG. 278. — Bill of a Flycatcher (*Tyrannus verticalis*, nat. size).

While having a close general resemblance to some of the foregoing insectivorous and oscine *Passeres*, the North American representatives of this family will be instantly distinguished by the above-described condition of the tarsus; together with the presence of 10 primaries, whereof the 1st is long or longest. From the birds of the following Picarian order by the Passerine characters of twelve rectrices, greater wing-coverts not more than half as long as the secondaries, and hind claw not smaller than the middle claw.

This family is peculiar to America; it is one of the most extensive and characteristic groups of its grade in the New World, the *Tanagridæ* and *Trochilidæ* alone approaching it in these respects. There are over 400 current species, distributed among about 100 genera and subgenera. As well as I can judge at present, at least two-thirds of the species are valid, or very strongly marked geographical races, the remainder being about equally divided between slight varieties and mere synonyms. Only a small fragment of the family is represented within our limits, giving but a vague idea of the numerous and singularly diversified forms abounding in tropical America. Some of these grade so closely toward other families, that a strict definition of the *Tyrannidæ* becomes extremely difficult; and I am not prepared to offer a satisfactory diagnosis of the whole group. Our species, however, are closely related to each other, and may readily be defined in a manner answering the requirements of the present volume. With a possible exception, not necessary to insist upon in this connection, they belong to the

FIG. 279. — Emargination of primaries in *Tyranninæ*. *a*, *Milvulus forficatus*; *b*. *Tyrannus carolinensis*; *c*. *Tyrannus verticalis*; *d*. *Tyrannus vociferans*; all nat. size. (Ad nat. del. E. C.)

29. Subfamily TYRANNINÆ: True Tyrant Flycatchers,

presenting the following characters: Wing of 10 primaries, the 1st never spurious nor very short; one or more frequently emarginate or attenuate on the inner web near the end. Tail of 12 rectrices, usually nearly even, sometimes deeply forficate. Feet small, weak, exclusively fitted for perching; tarsus little if any longer than middle toe and claw; anterior toes, especially the outer, extensively coherent at base. Bill very broad and more or less depressed at base, tapering to a fine point, thus presenting a more or less perfectly triangular outline when viewed from above; tip abruptly deflected and usually plainly notched just behind the bend; culmen smooth and rounded transversely, straight or nearly so lengthwise, except towards the end; commissure straight (or slightly curved) except at the end; gonys long, flat, not keeled. Nostrils small, circular, strictly basal, overhung but not concealed by bristles. Mouth capacious, its roof somewhat excavated; rictus ample and deeply cleft; commissural point almost beneath anterior border of eye. Rictus beset with a number of long stiff vibrissæ, sometimes reaching nearly to end of bill; generally shorter, and flaring outward on each side; other bristles or bristle-tipped feathers about base of bill. Bill very light, giving a resonant sound in dried specimens when tapped, and on being broken open, the upper mandible will be found extensively

hollow. These several peculiarities of the bill (to most of which *Ornithium* offers signal exception) are the most obvious features of the group; and should prevent our small olivaceous Flycatchers from being confounded even by the tyro with insectivorous Oscines, as the Warblers and Vireos. (See figs. 278, 280.)

The structure of the bill is admirably adapted for the capture of winged insects; the broad and deeply fissured mandibles form a capacious mouth, while the long bristles are of service in entangling the creatures in a trap and restraining their struggles to escape. The shape of the wings and tail confers the power of rapid and varied aërial evolutions necessary for the successful pursuit of active flying insects. A little practice in field ornithology will enable one to recognize the Flycatchers from their habit of perching in wait for their prey upon some prominent outpost, in a peculiar attitude, with the wings and tail drooped and vibrating in readiness for instant action; and of dashing into the air, seizing the passing insect with a quick movement and a click of the bill, and then returning to their stand. Although certain Oscines have somewhat the same habit, these pursue insects from place to place, instead of perching in wait at a particular spot, and their forays are not made with such admirable *élan*. Dependent entirely upon insect food, the Flycatchers are necessarily migratory in our latitudes; they appear with great regularity in spring, and depart on the approach of cold weather in the fall. They are distributed over temperate North America; many of them are common birds of the Eastern States. The voice, susceptible of little modulation, is usually harsh and strident, though some species have no unmusical whistle or twitter. The sexes are not ordinarily distinguishable (remarkable exception in *Pyrocephalus*), and the changes of plumage with age and season are not ordinarily great. The modes of nesting are too various to be collectively noted. The larger kinds of Flycatchers are unmistakable, but several of the smaller species, of the genera *Sayiornis*, *Contopus*, and especially *Empidonax*, look much alike, and their discrimination becomes a matter of much tact and diligence.

FIG. 280. — Generic details of *Tyranninæ*, *a. Myiarchus*; *b. Sayiornis*; *c. Contopus*; *d. Empidonax*; all nat. size. (Ad. nat. del. E. C.)

To the 8 genera of *Tyrannidæ* long known to be North American have lately been added 3 from Mexico — the immense-billed *Pitangus*, the streaky, yellow-bellied, rufous-tailed *Myiodynastes*, and the curious little "beardless" *Ornithium*. The 11 may be readily discriminated by the following characters: —

Analysis of Genera.

Bill flattish, fully bristled and hooked as usual in *Tyrannidæ*.

One or more outer primaries attenuate at end. A flame or yellow spot on crown. (*Tyranni.*)

Tail deeply forficate, much longer than wings . . . . . *Milvulus* 118

Tail simple, not longer than wings . . . . . *Tyrannus* 119

Outer primaries not attenuated. A yellow crown-spot.

Wings and tail extensively rufous; belly yellow; no streaks except on head . . . . *Pitangus* 116

Tail but not wings extensively rufous; belly yellow. Streaked above and below . *Myiodynastes* 117

Outer primaries not attenuate. Tail moderate. No yellow spot on crown. (*Tyrannulæ.*)

Tail chestnut and dusky, in lengthwise pattern. Belly yellow; throat ashy . . . . *Myiarchus* 120

Tail without chestnut.

Tail about equal to or little shorter than wing, slightly or not forked. Bill narrow. Tarsus

not shorter or rather longer than middle toe and claw. Coloration black and white, cinnamon-brown, or olivaceous . . . . . *Sayiornis* 121

Tail decidedly shorter than wing, a little forked. Bill broad and flat. Tarsus shorter than middle toe and claw. Olivaceous; length 6.25 or more . . . . . *Contopus* 122

Tail a little shorter than wing, about even. Bill flat. Tarsus not shorter or rather longer than middle toe and claw. Coloration olivaceous and yellowish, but no red, buff or pure brown. Length 6.25 or less — usually under 6.00 . . . . . *Empidonax* 123

Tail, etc., as in *Empidonax*, from which scarcely different. Coloration more brownish-olive, buffy below. Very small . . . . . *Mitrephanes* 124

Tail and tarsus as in *Empidonax*. Bill narrow. Hind not longer than lateral toe. Sexes unlike. ♂ full-crested, vermilion and pure brown . . . . . *Pyrocephalus* 126

Bill compressed, quite parine in appearance, unbristled, unnotched. General color ashy, with yellow lining of wings. Very small: length under 5.00 . . . . . *Ornithium* 125

Obs. Besides the above, another genus and species doubtless occurs in Texas: MYIOZETETES TEXENSIS. Bill short, stout, very broad at base, with curved culmen, hooked and notched tip, and heavily-bristled rictus. Primaries not emarginate; 2d, 3d, 4th longest, 5th shorter; 1st about equal to 6th. Tail shorter than wings, nearly square. Feet small; tarsus rather less than middle toe and claw. Above, olive; wings and tail brown, with yellowish edging of the quills. Under parts, including lining of wings, bright pure yellow; throat definitely white. Top and sides of head gray, hoary on forehead and over eyes, dusky on lores and auriculars, enclosing a flame and yellow crown-spot. Bill and feet black. Length about 7.00; wing 3.50; tail 3.00; bill 0.60; tarsus 0.75; middle toe and claw 0.85.

116. PITANGUS. (*Vox barb.*; a Mexican or S. Am. name of some bird.) DERBY FLYCATCHERS. Outer primaries not emarginate. An orange crown patch. Bill as long as head, exceeding the tarsus, straight, stout, but narrow, as deep as broad at the nostrils, with ridged culmen straight to the hooked end; gonys about straight, ascending; commissure and also lateral outlines perfectly straight. Nostrils rounded, nearer commissure than culmen. Wings rounded, tipped by 3d–5th quills; 2d and 6th about equal and shorter, 1st only about equal to 9th. Tail shorter than wings, nearly even, but somewhat double-rounded. Tarsus about as long as middle toe and claw. Largest-bodied of any N. Am. flycatcher. Brown above, yellow below, with black, white, and orange head; quills and tail-feathers extensively chestnut, as in *Myiarchus*. Mexican; lately found in Texas.

364. P. derbianus. (To Lord Derby. Fig. 281.) DERBY FLYCATCHER. Upper parts light wood-brown, with an olive tinge; wings and tail the same, but the feathers extensively bordered without and within with chestnut, forming a conspicuous continuous area on the wing-quills in the closed wing, and on most of the wing and tail-feathers more extensive than the brown portion of the inner webs. Below from the breast, including lining of wings, clear and continuous lemon-yellow. Whole chin and throat pure white, widening behind up under ear-coverts. Top and sides of head black, a circle of white from forehead over eyes to nape white, the enclosed black enclosing a lemon and orange patch. Or, middle of crown yellow and orange, enclosed and partly concealed in black, this black enclosed in white, then the long and broad black bar on side of head, separating the white of side of crown from that of side of throat. The coronal feathers lengthened and erectile as in a king-bird, or more so; crown-patch of same character but more extensive. Bill and feet black; iris hazel. Sexes alike. Length of male about 10.50; wing about 5.00; tail about 4.00; bill 1.20; tarsus 1.00. A great

FIG. 281. — Derby Flycatcher, nat. size. (Ad nat. del. E. C.)

flycatcher of aggressive appearance, long known in Mexico, recently ascertained to occur on the Lower Rio Grande in Texas.

117. **MYIODYNAS'TES.** (Gr. μυῖα, *muia*, a fly; δυναστής, *dunastes*, a ruler.) STRIPED FLYCATCHERS. Related to *Myiarchus;* tail extensively chestnut, as in that genus, but no chestnut on wings. No primaries emarginate. A yellow crown-spot. Bill shorter than head, as long as tarsus, very turgid, much broader than high at the nostrils, lateral outlines slightly convex, culmen nearly straight to the little hooked tip, gonys long, ascending. Rictus moderately bristled. Wings long and pointed; 3d quill slightly longer than 2d, 4th little shorter, 5th much shorter, 1st between 5th and 6th. Tail shorter than wings, nearly even. Feet very small, relatively as weak as in *Contopus;* tarsus rather shorter than middle toe and claw. Several species of Mexico and tropical Am. flycatchers, with crown-spot, rufous tail, and the whole plumage *streaked.*

365. **M. luteiven'tris.** (Lat. *luteus*, yellow, *ventris*, of *venter*, the belly.) SULPHUR-BELLIED STRIPED FLYCATCHER. Entire upper parts, including the head, streaked; the feathers with broadly dusky centres and olive-brown borders, finally edged slightly with yellowish-brown. A yellow crown-spot, concealed as in the king-bird. Tail and its upper coverts rich chestnut, all the feathers with blackish shaft stripes — on the middle feathers about half the width of either web, on the outer narrowed to the shaft itself and a slightly clubbed end; from below, shafts of the feathers white except at ends. Wings blackish, the median and greater coverts and inner quills, both externally and internally, conspicuously edged with yellowish-white; some rufous edgings also on lesser coverts. Under parts, including lining of wings, sulphur-yellow, fading to white on the throat; everywhere, excepting on middle of belly and crissum, heavily streaked with blackish, these dark stripes suffused and blended on the throat, particularly along its sides. Lores and auriculars dusky; forehead and streak over eye whitish. Bill blackish, pale at base below. Wing 4.40; tail 3.40; bill and tarsus 0.75; middle toe and claw rather more. Central Am. and Mexico to Arizona, where common, and breeding in southern parts of the territory.

118. **MIL'VULUS.** (Lat. *milvulus*, diminutive of *milvus*, a kite.) SWALLOW-TAILED FLYCATCHERS. Tail in the adult deeply forficate, about twice as long as the wing. Outer primary or primaries abruptly attenuate, and other characters as in *Tyrannus* proper (beyond). A yellow or flaming crown-spot.

Analysis of Species.

Three or four primaries emarginate. Crown-spot yellow, in black cap	*tyrannus*	366
One primary emarginate. Crown-spot flaming, in ashy cap	*forficatus*	367

366. **M. tyran'nus.** (Lat. *tyrannus*, a tyrant.) FORK-TAILED FLYCATCHER. ♂ ♀, adult: Outer 3 or 4 primaries emarginate. Crown-patch yellow. Above, clear ash; below, white; top and sides of head black; tail black, the outer feather white on outer web for about half its length; wings dusky, unmarked. Sexes alike. Young similar, but primaries not emarginate, nor tail lengthened; no crown-spot; wing- and tail-coverts edged with brown. Wing 4.50; tail up to a foot long, forked 6–8 inches. A beautiful bird of tropical Am., accidental in the U. S. (Louisiana, Kentucky, New Jersey!)

367. **M. forfica'tus.** (Lat. *forficatus*, forked like *forfer*, a pair of scissors. Fig. 282.) SWALLOW-TAILED FLYCATCHER. SCISSOR-TAIL. ♂ ♀, adult: First primary alone emarginate (fig. 279, *a*). Crown patch orange or scarlet. General color hoary-ash, paler or white below; sides at insertion of wings scarlet or bloody-red, and other parts of the body variously tinged with the same, or a paler salmon-red. Wings blackish, with whitish edgings. Tail black, but several of the long feathers extensively white or rosy; these are narrow and linear, sometimes widening somewhat in spoon-shape. Wing 4.50–5.00; extent of wings 14.50–15.50; tail up to a foot long, usually 8.00–10.00 inches, forked 5.00–6.00. ♀ averaging

smaller than ♂, with the tail commonly less developed. Young: Similar; primary not abruptly emarginate; tail undeveloped: no crown-spot, and little or no red. Lower Mississippi valley and Texas: usually N. to Indian Territory and Kansas, even S. W. Missouri: accidental in New Jersey and New England! A most elegant, graceful, and showy bird, abundant in Texas, conspicuous by the display it makes in opening and closing the tail, like scissor-blades: very active, dashing and noisy, like a king-bird, — all the large flycatchers sharing this same impetuous, irritable disposition. Nesting like the king-bird's: eggs 4–5, white, boldly blotched with reddish on the surface, and lilac shell-spots: laid in May.

Fig. 282. — Swallow-tailed Flycatcher. (Sheppard del. Nichols sc.)

119. **TYRANNUS.** (Lat. *tyrannus*, a tyrant.) King Flycatchers. Tail moderate in size and shape, rather shorter than wing, even or little rounded, emarginate or lightly forked. Wings long, pointed by the 2d–3d quills, 1st and 4th little if any shorter, 5th and rest rapidly graduated. Several outer primaries abruptly emarginate or sinuate-narrowed on inner webs towards end. Bill stout, flattish, fully bristled, notched, and hooked (fig. 278). Feet small and weak, the tarsus with scales obviously lapping around. Size large: length 8 inches or more: wing over 4. Sexes alike; ♀ sharing the flaming crown-patch: primaries less or not emarginate? Young lacking the crown-spot and attenuation of primaries. Nest bulky, on a bough, compactly woven and felted. Eggs white, boldly marked with oval or tear-shaped spots of reddish-brown. Contains numerous species, 5 of N. Am., which have been divided into several named subgenera, but are closely interrelated through various exotic species. They are the "king-birds" proper.

Analysis of Species.

No olive nor decided yellow; blackish and whitish.
- Only two primaries obviously emarginate. Tail about even, conspicuously white-tipped. Bill small, under 1.00. (*Tyrannus*) . . . . . *carolinensis* 368
- Five or six primaries emarginate. Tail emarginate, merely lighter at end. Bill big, 1.00 long. (*Melitarchus*) . . . . . *dominicensis* 369

Olivaceous, with pure yellow on belly, ashy on head. Bill moderate. (*Laphyctes.*)
- Tail blackish, merely emarginate; wings dark brown.
  - Several outer primaries gradually attenuate for a long distance. Outer web of outer tail-feather white . . . . . *verticalis* 370
  - Several outer primaries abruptly emarginate for a short distance. Outer web of outer tail-feather merely whitish-edged . . . . . *vociferans* 371
- Tail dark brown, like the wings, obviously forked
  - Several outer primaries abruptly emarginate for a short distance . . . . . *couchi* 372

368. **T. carolinensis.** (Of Carolina. Fig. 283.) King-bird. Bee-martin. ♂♀, adult: No olive nor decided yellow. Only two outer primaries obviously emarginate (fig. 279, *b*). Tail nearly even — if anything a little rounded. Blackish-ash, still darker or quite black on head, crown with a flaming spot. Below, pure white, the breast shaded with plumbeous. Wings dusky, with much whitish edging. Tail black, broadly and sharply tipped with white, the outer feather sometimes edged with the same. Bill and feet black. Young: Lacking emargination of the primaries, and no crown-spot; very young birds show rufous

edging of the wings and tail. Length about 8.00; extent 14.50; wing 4.50; tail 3.50, even or slightly rounded; bill small, under an inch long. Temperate N. Am., but chiefly E. U. S. to Rocky Mts.; rare or casual on the Pacific slope; abundant in summer; breeds throughout its range; winters on the southern border and beyond. This trim and shapely "martinet," in severe black and white but with fiery pompon, is familiar to all, and equally noted for its irritability, pugnacity, and intrepidity, and its inveterate enmity to crows, hawks, and owls, which it does not hesitate to attack, either in defence of its nest or just to show its spunk. Nest a conspicuous object in the orchard or by the wayside, on the horizontal bough of a tree, large, cupped, compactly woven and matted with fibrous and disintegrated vegetable substances; eggs usually 4–5–6, 0.90 to 1.00 long by 0.72 broad, white, rosy, or creamy, variously spotted or blotched in bold pattern with reddish and darker brown surface-spots and lilac shell-markings. Destroys a thousand noxious insects for every bee it eats!

FIG. 283.—King-bird, reduced. (From Tenney, after Wilson.)

369. T. dominicen'sis. (Of St. Domingo.) GRAY KING-BIRD. ♂ ♀, adult: Five or six outer primaries usually emarginate. Crown-spot as before. Grayish-plumbeous, rather darker on head, the auriculars dusky. Below, white, shaded with ashy on breast and sides, the under wing- and tail-coverts faintly yellowish; wings and tail dusky, edged with whitish or yellowish; the tail-feathers merely indistinctly lighter at the extreme tip. Larger than the last: Length about 9.00; wing 5.50; tail nearly 5.00, more or less emarginate; bill very turgid, an inch long. West Indies; Florida regularly; N. to Carolina rarely, to Massachusetts accidentally. General appearance, habits and nesting of the king-bird.

370. T. vertica'lis. (Lat. *verticalis*, relating to the *vertex*, or top of head, which has a flame-patch. Fig. 278.) ARKANSAS TYRANT FLYCATCHER. Several outer primaries gradually attenuated for a long distance (fig. 279, *c*). Coloration olivaceous and yellow; belly and under wing- and tail-coverts clear yellow; back ashy-olive, changing to clear ash on the head, throat, and breast, the chin whitening, the lores and auriculars dusky; wings dark brown with whitish edging; tail black or blackish; bill and feet black; iris brown. Outer web of outer tail-feather entirely white. Ash of the fore parts pale, contrasting with dusky lores and auriculars, fading insensibly into white on the chin, and changing gradually to yellow on the belly; olive predominating over ashy on the back. Length about 9.00; extent about 16.50; wing 5.00; tail 4.00; bill 0.75; tarsus 0.75. Young: Similar; general ash of the body dull, with a brownish cast; little or no olivaceous on back; tail not quite black; yellow of under parts pale and sulphury, even whitish; bill light-colored at base below; no color on crown, and primaries scarcely or not attenuate. Very young with rusty edgings, especially on wing- and tail-coverts. Western U. S., abundant; accidental in Louisiana, New Jersey, and Maine; E. regularly to Kansas, Iowa, etc., N. to British Provinces in Missouri and Milk River region and westward. General traits those of the king-bird; nest similar, rather larger, with more fluffy and less fibrous material; eggs not distinguishable with certainty.

371. T. voci'ferans. (Lat. *vociferans*, vociferous, voice-bearing; *vox*, voice, and *fero*, I bear.) CASSIN'S TYRANT FLYCATCHER. Several outer primaries abruptly emarginate for a short distance (fig. 279, *d*). Outer web of outer tail-feather barely or not edged with whitish. General coloration as in *T. verticalis;* but ash of fore parts dark, little different on the lores and auriculars, changing rather abruptly to white on the chin and to yellow on the belly; ashy predominating over olive on the back. The difference is decisive on comparison. The outer primaries are abruptly nicked and narrowed within half an inch of the end. The mere edging of the outer

tail-feather with white instead of the whole web being white is also a good character. Changes of plumage the same as in *verticalis;* size the same; bill rather stouter, about 0.85; tarsus slightly longer, on an average. Southwestern U. S., and southward; N. to Wyoming and Idaho; abundant in the Rocky Mt. region, there mostly replacing *verticalis* in the breeding season. Nesting and eggs the same.

372. **T. melancho'licus couch'i.** (Gr. μελαγχολικός, *melagcholikos*, Lat. *melancholicus*, melancholy, i. e., atrabilious; μέλας, μέλανος, *melas, melanos*, black; χόλος, *cholos*, gall, bile. To Lt. D. N. Couch.) COUCH'S FLYCATCHER. Very similar to the last; primaries abruptly emarginate for a short distance, as in *T. vociferans*, and outer web of outer tail-feather not white; but tail dark brown, like the wings, and obviously forked (about 0.50; in *vociferans* the tail quite black, slightly emarginate or nearly even); all its feathers with slight pale edges, and their shafts pale on the under surface. Yellow of under parts very bright, reaching high up on the breast; throat as well as chin extensively white. Size of the foregoing, and changes of plumage coincident. A universally distributed South and Central Am. species, of which a slight variety reaches over our Mexican border.

120. **MYIAR'CHUS.** (Gr. μυῖα, *muia*, a fly; ἀρχός, *archos*, a ruler. Fig. 280, *a*.) CRESTED FLYCATCHERS. ASH-THROATED FLYCATCHERS. RUFOUS-TAILED FLYCATCHERS. No colored patch on the crown, but head slightly crested by lengthened erectile feathers. Primaries emarginate. Olivaceous; more or less yellow below, the throat ash, the primaries margined with chestnut, the tail-feathers the same or mostly chestnut — such coloration the best mark of the genus. Tail nearly even, if anything rounded, about as long as wings, of broad flat feathers with rounded ends. Wings rounded, the tip formed by 2d–4th quills (usually), the 5th shorter, 6th and 1st much shorter. Tarsus about as long as middle toe and claw, — if any different, longer. Bill moderate, variable in shape and relative size. Next to the characteristic rufous on wings and tail, size is a good clue to this genus among our olivaceous flycatchers without colored crest; for the *Myiarchi* excepting *M. lawrencii* are much larger than any others excepting *Contopus borealis* and *C. pertinax*. Only one Eastern species, but four others in the southwest, requiring nice discrimination. Peculiar, all of them, in nesting in holes, and laying eggs scratched and snarled, but chiefly scrawled lengthwise, with dark brown, in close and intricate pattern.

Analysis of Species and Varieties.

Large: length 8.00 or more. Inner webs of tail-feathers largely rufous.
- Rufous occupying nearly or quite all the inner webs of several lateral tail-feathers . . . . *crinitus* 373
- Rufous occupying inner webs of same feathers in nearly equal amount with a fuscous stripe of equal width throughout. Bill nearly or quite 1.00 . . . . . *cooperi* 880
- Rufous occupying inner webs of same feathers in nearly equal amount with a fuscous stripe of equal width throughout. Bill about 0.75 . . . . . *erythrocercus* 374
- Rufous occupying inner webs of same feathers in greater amount than a fuscous stripe which widens at end. Bill very narrow . . . . . *cinerescens* 375

Small: length 7.00 or less. Inner webs of tail-feathers scarcely or not rufous . . . . . *lawrencii* 376

373. **M. crini'tus.** (Lat. *crinitus*, haired, i. e., crested; *crinis*, hair. Fig. 284.) GREAT CRESTED FLYCATCHER. ♂ ♀, adult: Decidedly olivaceous above, a little browner on head, where the feathers have dark centres; throat and fore breast pure dark ash; rest of under parts bright yellow, the two colors meeting abruptly; primaries margined on both edges with chestnut; secondaries and coverts edged and tipped with yellowish-white; tail with all the feathers but the central pair chestnut on the whole of the inner web (excepting perhaps a very narrow space next the shaft); outer web of outer feathers edged with yellowish; middle feathers, outer webs of the rest, and wings except as stated, dusky-brown. The foregoing phrases are intended to be chiefly antithetical to those used in describing *cinerescens*, below, No. 375. Other diagnostic points are: bill dark but not quite black, pale at base below; stout and comparatively short, hardly or not as long as tarsus, the latter perhaps never 0.90.

the olive back, ash throat, and yellow belly severally pure in color; all tail-feathers but middle pair so extensively rufous on inner webs that a mere line, if any, of fuscous persists next the shaft (compare *erythrocercus* and *cooperi*), and this fuscous line, if any, running of same narrowness to ends of the feathers (compare *cinerescens*); never more than a trace of rufous on outer webs. Very young birds have rufous skirting of many feathers, in addition to the chestnut above described, but this soon disappears. Large: length 8.00–9.00; extent about 13.00; wing and tail about 4.00 (3.80–4.20); bill 0.75–0.80; tarsus 0.70–0.80; middle toe and claw 0.65–0.75; breadth of bill at base 0.33–0.40, or about ½ the length of culmen. Eastern U. S., west to Missouri, Kansas, Arkansas, and Texas, N. to Massachusetts; Mexico and Central Am. in winter. An abundant bird, in woodland, of loud harsh voice and quarrelsome disposition, noted for its habitual use of cast-off snake-skins in the structure of its nest. Nest in hollows of trees and similar retreats; eggs unique (outside this genus) in pattern: ground color buff or rich clay-color, with numberless markings of purplish-chestnut, or purplish-chocolate, and others paler, sharp and scratchy, mostly lengthwise, but especially at the butt tangled up; size about 0.85 × 0.62. Breeds throughout its U. S. range, but entirely withdraws in winter. Locally and irregularly distributed in woodland.

FIG 284.—Great Crested Flycatcher, reduced. (Sheppard, del. Nichols sc.)

880. (in addenda.) **M. c. coo'peri.** (To Wm. Cooper.) COOPER'S LARGE-BILLED CRESTED FLYCATCHER. Distinguished in its extreme development from *crinitus* by its rather greater size, and especially the great size of the bill, which runs from 0.80 fully up to 1.10 measured along culmen, equalling or even exceeding in length the tarsi, which are themselves usually 0.10 longer than in *crinitus*. The olivaceous is usually not so pure, and the yellow not so clear; but the chief difference is, that the inner webs of the tail-feathers have a fuscous stripe ¼ to nearly ½ the width of the feather, as in *erythrocercus;* from which latter it differs mainly in the greater size, especially of the bill. Wings and tail 3.90–4.25; bill 0.80–1.00; tarsus 0.85–0.95; Mexico and over the U. S. border; Arizona. (*Tyrannula cooperi*, Kaup, 1851? *M. cooperi* Bd., 1858. *M. crinitus* var. *cooperi*, Coues, Pr. Phila. Acad., 1872, p. 67.)

374. **M. c. erythrocer'cus.** (Gr. *ἐρυθρός, eruthros,* reddish; *κέρκος, kerkos,* tail.) RUFOUS-TAILED CRESTED FLYCATCHER. On comparing this bird with typical *M. crinitus*, it is immediately perceived to be different. The lateral tail-feathers have a stripe of fuscous on the inner web adjoining the shaft, this stripe equalling or exceeding the width of the whole outer web of the respective feathers, and being about half-and-half with the rufous; whereas in *crinitus* there is only the narrowest possible dusky stripe on the inner web, or none at all. This dusky stripe is of uniform width throughout, not enlarged at the end to occupy most or all of the feather, as is the case with *cinerescens*. The entire upper parts are darker than those of *crinitus* — that is, they have a sordid brownish-olive cast, instead of the clearer and purer greenish-olive of *crinitus*. The yellow of the belly is much paler. The ash of the throat is decidedly lighter and clearer, and it comes farther down the breast, yielding to the yellow without the intervention of the olivaceous pectoral area which is usually conspicuous in *crinitus*. The general aspect of the under parts is much as in *cinerescens*, both the distribution and shade of the colors being more as witnessed in the latter than as seen in *crinitus*. The light edgings of the wing-feathers are also paler than those of *crinitus*. The bill is black, not dark brown, slenderer than in *crinitus;* in size nothing like that of *cooperi*, nor has it the very constricted shape of that of

cinerescens. The general body-coloration is almost exactly as in *cinerescens*, from which it is at once distinguished by the different shape of the bill and different pattern of the tail-feathers. Agreeing very closely in colors with *cooperi*, it is smaller than that species, and lacks in particular the enormous development of the bill, which, in *cooperi*, is an inch or more in length of culmen, and proportionately broad. It is clearly neither *crinitus* proper, nor *crinitus cooperi*, nor yet *cinerescens*. Average length 8.75; extent about 12.75; wing 3.60–4.00; tail 3.75; bill 0.75; tarsus 0.85; middle toe and claw 0.75. Lower Rio Grande of Texas, and southward. Common, breeding. Nest and eggs like those of *crinitus*. (*M. crinitus* var. *irritabilis*, Coues, Pr. Phila. Acad., 1872, p. 65, nec *Tyrannus irritabilis* Vieill. · *M. crinitus erythrocercus*, Coues, Bull. U. S. Geol. Surv., iv, 1878, p. 32, and v, 1879, p. 402. *M. mexicanus* var. *cooperi*, Ridg., Pr. Nat. Mus., i, p. 138, nec *cooperi* Bd. · *M. mexicanus*, Ridg., Pr. Nat. Mus., ii, p. 14.)

375. **M. cineres'cens.** (Lat. *cinerescens*, ashy. Fig. 285.) ASH-THROATED CRESTED FLYCATCHER. ♂♀, adult: Rather olivaceous-brown above, quite brown on the head; throat very pale ash, sometimes almost whitish, changing gradually to very pale yellow or yellowish-white on the rest of the under parts. Primaries edged as in *crinitus*, but secondaries and coverts edged with grayish-white. Tail-feathers as in *crinitus*, but the rufous of the inner webs hardly or not reaching their ends, being cut off from the tip by widening of the fuscous stripe (in young birds, in which the quills and tail-feathers are more extensively rufous-edged, the last distinction does not hold). Size of *crinitus*, but tarsi longer and bill slenderer; tarsi 0.80–0.90; bill 0.75–0.85, but only 0.27–0.33 broad at the base, where only about as wide as high, and obviously narrower than in *crinitus;* though in Cape St. Lucas specimens (*M. pertinax* Bd.) shaped quite as in *crinitus*, but smaller. Southwestern U. S.; N. to Wyoming and Utah and Nevada; S. through Mexico; E. and W. from Texas to the Pacific; said to winter in the Lower Colorado valley, U. S. Though so similar to the foregoing, it is a different bird from any of them. Nesting and eggs as in the others. (*M. mexicanus* Bd., 1858, nec Kaup, 1851. *Tyrannula cinerascens*, Lawr., 1851. *M. cinerescens* Coues, 1872.)

FIG. 285. — Ash-throated Flycatcher, reduced. (Sheppard del. Nichols sc.)

376. **M. lawren'cii.** (To Geo. N. Lawrence.) LAWRENCE'S CRESTED FLYCATCHER. Similar in color to *M. crinitus*, but *much* smaller. No chestnut on tail-feathers except a narrow bordering on the *outer* webs, and, in the young, an inner *margining* also. Wing-coverts and inner secondaries as well as the primaries edged with rufous (rarely yellowish on inner secondaries); pileum dark or quite blackish. Bill broad, flat, shaped much as in *Contopus*, about ½ its own length wide at the nostrils. Very small: length 7.00 or less; wing and tail only 3.00–3.33; bill 0.62–0.70; tarsus 0.65–0.75. Texas (?), Mexico, and Central Am., there running into *M. nigricapillus*.

121. **SAYIORNIS.** (Name of Thos. Say, with Gr. *ὄρνις*, *ornis*, a bird.) PEWIT FLYCATCHERS. The 3 following species do not particularly resemble each other; most authors place them in separate genera, and some even under different subfamilies, of *Tyrannidæ*. The discrepancies of form, however, are not startling, and for the purposes of this work the species may be properly put together, as they agree in presenting a certain aspect not shown by the other N. Am. groups. (Fig. 280, *b*.) They are small species, about 7.00 or less in length. Head with a slight crest of erectile feathers. Tarsus rather longer than middle toe and claw (the reverse

in *Contopus*). Bill *narrower* than in the other little Flycatchers, with nearly straight lateral outlines, its width at base about ½ the length of culmen. Wing pointed by 2d-5th quills, 1st shorter than 6th. Tail about as long as wing, emarginate, with broad feathers tending to divaricate in the middle. One Eastern, two Western species. Nest affixed to rocks and buildings, with mud; eggs normally white, unmarked.

Analysis of Species.

Ashy-brown, with cinnamon belly and black tail . . . . . *sayi* 377
Blackish, with white belly . . . . . *nigricans* 378
Olivaceous and yellowish . . . . . *fusca* 379

† **377. S. say'i.** (To Thos. Say.) SAY'S PEWIT FLYCATCHER. ♂ ♀, adult: Grayish-brown, sometimes with faint olivaceous tinge, rather darker on head, where the feathers have dusky centres, paler on throat and breast, then changing to cinnamon-brown on the rest of the under parts. Wings dusky, lined with tawny-whitish, edged with whitish on the coverts and inner quills. Tail perfectly black. Bill and feet black. Iris dark brown. Length about 7.00; extent 11.00; wing 3.75–4.35; tail 3.25–3.50; bill 0.50–0.60, narrow and slender for a flycatcher; tarsus 0.80; middle toe and claw 0.67. Young: More extensively fulvous or paler cinnamon than the adults, this color extending far up the breast, skirting the feathers of the back and rump, forming conspicuous cross-bars and edgings on the wings, and even tipping the tail. But no bird of our country resembles this one. Western U. S. and adjoining British Provinces, E. to Kansas, Iowa, Wisconsin, etc., common in open or rocky country, where seen singly or in pairs; the principal flycatcher of *unwooded* regions, in weedy, brushy places, displaying the usual activity of its tribe, and uttering a melancholy note of one syllable, or a tremulous twitter. Nests naturally on rocks, but soon adapts itself to buildings like the Eastern Pewee. Nest of mud, straw, moss, feathers; eggs 4–5, 0.80 × 0.62, white.

† **378. S. nig'ricans.** (Lat. *nigricans*, blackening.) BLACK PEWIT FLYCATCHER. Sooty-brown or blackish, deepest on head and breast; belly and other under parts pure white, abruptly defined; lining of wings, outer web of outer tail-feathers, and edges of inner secondaries, whitish; bill and feet black; iris red. The coloration is curiously like that of *Junco hiemalis*. Length about 7.00; wing 3.50–3.75; tail 3.25–3.50; bill 0.50 or less, very weak; tarsus 0.67; middle toe and claw 0.60. Southwestern U. S. and southward, but on the Pacific to Oregon; chiefly in unwooded country, and especially along rocky streams, and in cañons — I have seen it at the *bottom* of the Grand Cañon of the Colorado, some 6,000 feet below the surface of the earth! Nest of mud, etc., on rocks and walls; eggs 0.75 × 0.56, white.

FIG. 286.— Pewit Flycatcher, reduced. (Sheppard del. Nichols sc.)

379. S. fus'ca. (Lat. *fusca*, brown. Fig. 286.) PEWIT FLYCATCHER. WATER PEWEE. PEWIT. PHŒBE. Dull olivaceous-brown, the head much darker fuscous-brown, almost blackish, usually in marked contrast with the back; below, soiled whitish, or palest possible yellow, particularly on the belly; the sides, and the breast nearly or quite across, shaded with grayish-brown; wings and tail dusky, the outer tail-feather, inner secondaries, and usually the wing-coverts, edged with whitish; a whitish ring round the eye; bill and feet black. Varies greatly in shade; the foregoing is the average spring condition. As summer passes, the plumage becomes much duller and darker brown, from wearing of the feathers; then, after the moult, fall specimens are much brighter than in spring, the under parts being decidedly yellow, at least on the belly. Very young birds have some feathers skirted with rusty, particularly on

the edges of the wing- and tail-feathers. The sexes are alike, the ♀ averaging at the lesser dimensions of the ♂. The species requires careful discrimination, in the hands of a novice, from any of the little olivaceous species of the next two genera. It is larger; length 6.75–7.25; extent 10.75–11.75; wing 3.00–3.50, usually 3.40; tail about the same, slightly emarginate; bill 0.50 or slightly more, little depressed, not so broad for its length as is usual in *Contopus* and *Empidonax*, its lateral outlines straight; tarsus equalling or slightly exceeding the middle toe and claw, these together about 1.33 long; point of the wing formed by the 2d to 5th quill: 2d shorter than 6th; 3d and 4th generally a little the longest; 1st shorter than 6th. Eastern U. S., and British Provinces, very abundant in open places, fields, along streams, and almost as domestic as the barn swallow. One of the very earliest arrivals in spring, and a late loiterer in fall: winters abundantly in the Southern States. West to Dakota, Nebraska, etc. Its ordinary note is harsh and abrupt, unlike the drawling *pe-a-wee'* of *Contopus virens*—sounding like *pē-wīt' phē'-bĕ*, whence the name. The typical nest is affixed to the side of a vertical rock over water, often itself moist or dripping, and composed of mud, grass, and especially moss, making a pretty object, lined with hay or feathers. The bird now builds anywhere about houses, bridges, and other buildings; its attachment to particular spots is so strong that it will return year after year, and often persist in nesting under the most discouraging circumstances. Eggs 4–5–6, 0.80 × 0.60, normally pure white, not seldom sparsely dotted.

122. CONTOPUS. (Gr. κόντος, *kontos*, a pole or perch, and πούς, *pous*, foot. Fig. 280, *c*.) WOOD PEWEE FLYCATCHERS. With the feet extremely small; tarsus shorter or not longer than the *bill*, shorter than the middle toe and claw (except in *pertinax*); the tarsus, middle toe, and claw together, barely or not one-third as long as the wing; bill flattened, very broad at base; wings pointed, much longer than the emarginate tail, the proportions of the primaries varying with the species. Medium-sized and rather small species, brownish-olivaceous, without any bright colors or very decided markings; the coronal feathers lengthened and erectile, but hardly forming a true crest. A small group of woodland species, near *Empidonax*, but characterized, as above described, by the feeble diminutive feet. Nest on boughs; eggs spotted.

Analysis of Species.

Species 7-8 long, with a tuft of white fluffy feathers on the flank.
- Under parts *streaky*. Wing pointed by 2d primary, supported nearly to end by 1st and 3d, 4th much shorter. Tail about 3.00; wing about 4.00. Tarsus shorter than middle toe and claw. . . *borealis* 380
- Under parts more smooth in color. Wing pointed by 2d, 3d, and 4th quills, 1st much shorter; tail 3.50 or more; wing about 4.00. Tarsus not shorter than middle toe and claw . . . . . *pertinax* 381

Species under 7.00 long, without an evident cottony white tuft on the flank.
- Tarsus, middle toe, and claw together hardly or not 1.00 long . . . . . *virens* 382, 383

380. C. borealis. (Lat. *borealis*, northern.) OLIVE-SIDED FLYCATCHER. Dusky olivaceous-brown, usually darker on the crown, where the feathers have blackish centres, and paler on the sides below; chin, throat, belly, crissum, and middle line of breast, *white*, more or less tinged with yellowish; wings and tail blackish, unmarked, excepting inconspicuous grayish-brown tips of the wing-coverts, and some whitish edging on the inner quills; feet and upper mandible black, lower mandible mostly yellowish. The olive-brown below has a peculiar *streaky* appearance hardly seen in other species, and extends almost entirely across the breast. This ragged aspect of mixed dusky-olive and whitish, together with the large white fluffy flank-tufts, is diagnostic. *Young* may have the feathers, especially of the wings and tail, skirted with rufous. Length 7.00–8.00; wing 3.87–4.33, averaging 4.00, very long, folding to terminal third of tail, and remarkably pointed: 2d quill longest, supported nearly to the end by the 1st and 3d, the 4th abruptly shorter; tail about 3.00, thus about ¾ the wing, emarginate; tarsus only 0.50, shorter than bill, or than middle toe and claw; tarsus, middle toe, and claw together only about 1.25; bill 0.67–0.75. N. Am. at large, apparently nowhere very abundant, rather common in some New England localities, very rare in the Middle and Southern States, less so in the West. N. even to Greenland: S. to Central America in winter. Breeds from New England north-

ward, and much further south in the West. Generally seen high on some exposed outpost; note querulous, but loud and harsh. Nest usually high, on a horizontal bough, rude and flat, of twigs, rootlets, grass, moss; eggs about 4, 0.85 × 0.65, buffy or creamy-white, fully spotted with lighter and darker reddish-browns. A stocky, able-bodied, dark and streaky species, quite unlike any other.

381. C. per'tinax. (Lat. *pertinax*, pertinacious; pertaining to *C. borealis; per*, and *tenax*, tenacious.) COUES' FLYCATCHER. Somewhat similar to *C. borealis;* colors more uniform and more clearly olive; below, dull brownish-olive, lighter on throat, fading insensibly on belly into dingy yellowish-white; lacking the peculiar streaky appearance of *C. borealis.* Cottony tufts on the flanks less conspicuous. Bill longer and comparatively narrower than in *borealis;* black above, yellow below; feet black. Wing-formula entirely different; 2d, 3d, and 4th quills nearly equal and longest, 1st abruptly 0.50 shorter, about as long as 5th, or between 5th and 6th. Feet small, weak, and properly "contopine," but tarsus if anything longer, not shorter, than middle toe and claw, about equalling the bill (the reverse proportion of bill, tarsus, and toe obtains in *C. borealis*). Length of ♂ about 8.00; extent 13.00; wing 4.00–4.30; tail 3.50–3.80; bill and tarsus, each, about 0.67; middle toe and claw 0.60. ♀ rather less. Young: Lower mandible and mouth orange-yellow; feathers of wings and tail and their coverts skirted with rusty, and a shade of the same on the under parts generally. Midsummer adults wear browner, like the common wood pewee; and, in fact, the whole coloration of the species is the counterpart of a wood pewee's. Mexico, N. into Arizona, where common in the pine woods.

382. C. vi'rens. (Lat. *virens*, virent, greenish. Fig. 287.) WOOD PEWEE. Olivaceous-brown, rather darker on head; below, with sides washed with a paler shade of the same, reaching nearly or quite across the breast; throat and belly whitish, more or less tinged with dull yellowish; under tail-coverts the same, usually streaked with dusky; tail and wings blackish, the former unmarked, the inner wing-quills edged, and the greater and middle coverts tipped, with whitish; feet and upper mandible black, under mandible usually yellow, sometimes dusky; iris brown. Spring specimens are purer olivaceous; early fall birds are brighter yellow below; in summer, before the worn feathers are renewed, the plumage is quite brown and dingy whitish. Very young birds have the wing-bars and edging of quills tinged with rusty, the feathers of the upper parts skirted, and the lower plumage tinged, with the same; but in any plumage the species may be known from all the birds of the following genus, by these dimensions: Length 6.00–6.50; extent 10.00–11.00; wing 3.25–3.50; tail 2.75–3.00; tarsus, middle toe and claw together hardly one inch, or evidently less; tarsus alone about 0.50, not longer than the *bill.* Bill very flat, its breadth at base more than one-half its length; lateral outline bulging. Wings very long and pointed; 2d quill longest, 3d little if any less, 4th shorter, 1st between 4th and 5th. Tail but little (about 0.50) shorter than wing, emarginate. Eastern N. Am., in woodland; extremely abundant in most U. S. localities, May–Sept., entering U. S. from the South usually in March, reaching its limit of dispersion by the end of April or early in May. Possibly winters along the southern border. West only to the high central plains. In the breeding season the peculiarly plaintive, drawling note may be heard in almost any piece of woods, while the dolorous little bird is at his post, perched on some exposed twig near his nest, and continually raiding after insects, which he captures with a quick twist in the air and a click of the bill, regaining his perch adroitly, and standing erect with hanging tail and wings. Nest a very pretty structure, saddled on a horizontal bough, flat and thin-bottomed, with thick walls and

FIG. 287. — Wood Pewee, reduced. (Sheppard del. Nichols sc.)

well-turned brim, of fine fibres stuck over with lichens, the whole looking much like a natural excrescence of the tree. Eggs 4–5, creamy-white, marked with reddish-brown and lilac in various pattern, usually wreathing and blending about the larger end, sparser elsewhere; size about 0.75 × 0.65 — *pē-ā-wee'! ā-pē-wee'!*

383. **C. v. rich'ardsoni.** (To Sir John Richardson.) Western Wood Pewee. Similar; darker, more fuscous-olive above, the shading of the sides reaching almost uninterruptedly across the breast; belly rather whitish than yellowish; outer primary usually not obviously white-edged; bill below oftener dusky than yellow, sometimes quite black. I fail to appreciate any reliable differences in size or shape; or, in fact, *any* specific character. It is impracticable to pronounce upon a pewee, in the closet, without knowing the locality; but those familiar with both Eastern and Western birds in field, agree that they are not exactly the same. Note not exactly like that of *virens;* nesting said to be different (*Audubon, Allen*). Rocky Mountains to the Pacific; "Labrador" (*Audubon*). (*Tyrannula richardsonii* Sw., Fn. Bor.-Am., ii, 1831, p. 146? *Contopus richardsonii* Bd., B. N. Am., 1858, p. 189; *Muscicapa phœbe* Aud., B. Am., 8vo. ed., i, 1840, p. 219, pl. 61; Nutt., Man. i, 2d ed., 1840, p. 319. See Coues, B. N. W., 1874, p. 247.)

123. **EMPIDO'NAX.** (Gr. ἐμπίς, gen. ἐμπίδος, *empis, empides,* a gnat; ἄναξ, *anax,* king. Fig. 280, *d.*) The Little Olivaceous Flycatchers. Small olivaceous species, 5.00–6.00 (rarely 6.25) long; wing 3.12 *or less;* tail 2.75 *or less;* whole foot at least ½d as long as wing; tarsus more or less obviously longer than middle toe and claw, much longer than bill; 2d, 3d and 4th quills entering into point of wing, 1st shorter or not obviously longer than 5th; tail not over ¼ an inch shorter than wings; breast not buffy. (Compare *Sayiornis, Contopus, Mitrephanes.*) As in allied genera, several outer primaries are slightly emarginate on the inner web, but this character is obscure, often inappreciable, and may be disregarded. The coronal feathers are lengthened and erectile, but scarcely form a true crest. There are never any more conspicuous color-marks than in *Sayiornis fusca* or *Contopus virens.* The bill varies with the species in size and shape, from almost as broad and flat as in a wood pewee in *acadicus,* to the narrower shape of a pewit in *obscurus;* but it is always much shorter than the tarsus. It should not be difficult to recognize *Empidonax* as different from *Contopus,* due attention being given to the nice points of diagnosis; but it is a very difficult matter to discriminate the numerous species, requiring much tact, care, and patience. The following account, carefully prepared after examination of a great amount of material from all parts of the country, will probably suffice to determine ninety out of a hundred specimens; but I confess it does not entirely satisfy me; and, as it does not fully answer all the requirements of the case, it must be regarded as provisional. How much alike are these interesting little birds may be inferred from the fact that Wilson knew but a single species, *acadicus,* to which Audubon added but one, *trailli,* until Baird showed him two more, *minimus* and *flaviventris.* Yet these four are perfectly distinct birds. Any experienced collector knows them to be different, not only when he has them in hand, but in life, by their haunts and habits, their notes, nests and eggs — indeed, the nests and eggs of each of them are readily discriminated. Three of them are common New England breeders — *trailli, minimus,* and *flaviventris;* while *acadicus* is the common breeder in the Middle States. The case is complicated, however, in the West. The two exclusively Western species, *hammondi* and *obscurus,* are pretty distinct — entirely so from each other: but the recognition of "*pusillus*" and especially "*difficilis*" is somewhat conventional. Since 1858, when Baird first fixed the species upon anything like a satisfactory footing, no changes whatever of his determinations and characterizations have been established: and as it is useless to exchange one doubtful opinion for another, the less obvious species may be suffered to remain as he left them. It is not reasonably possible to analyze all the forms in concise phrase; the student must go at once to the detailed descriptions; but the following may help him somewhat: —

Exclusively Eastern Species.

Largest: rather over than under 6.00; wing nearly or over 3.00; tarsus 0.67; middle toe and claw 0.50; bill nearly or quite 0.50. Clear light olive-green above, below whitish; wing-bars and eye-ring *tawny*. Nest *flat* in fork of a horizontal bough; eggs *speckled*. Not New England . . . . . *acadicus* 384

Medium: rather under 6.00; wing 2.70; tarsus 0.67, but middle toe and claw 0.60; bill hardly 0.50. Olive *brown* above, below grayish; wing-bars and eye-ring *whitish*. Nest a bulky cup in a *bush*, eggs *speckled*. New England . . . . . *trailli* 385

Small: rather under 5.50; proportions and colors nearly as in *trailli*. Nest a neat cup in upright crotch of a *tree*; eggs *white*. Commonest breeder in S. New England . . . . . *minimus* 387

Medium: under parts *thoroughly yellow*. Nest *near ground* in a stump or log, bulky. Eggs *speckled*. New England . . . . . *flaviventris* 388

Exclusively Western Species.

The representative of *trailli*. Eggs speckled . . . . . *pusillus* 386

The representative of *flaviventris*. Eggs speckled . . . . . *difficilis* 389

Small, and otherwise like *minimus*; dark below, breast not very different from back; bill extremely narrow. Eggs white . . . . . *hammondi* 390

Large, about the size of *acadicus*; olive-brown above; breast dark; outer tail-feather white on outer web; bill very narrow. Eggs white . . . . . *obscurus* 391

384. E. acadicus. (Lat. of Acadia.) SMALL GREEN-CRESTED *or* ACADIAN FLYCATCHER. Above, olive-*green*, clear, light, continuous and uniform (though the crown may show rather darker, owing to dusky centres of the slightly lengthened, erectile feathers); below, *whitish*, olive-shaded on sides and nearly across breast, yellowish-washed on belly, flanks, crissum and axillars; wings dusky, inner quills edged, and coverts tipped, with *tawny* yellow; all the quills whitish-edged internally; tail dusky, olive-glossed, unmarked; a *tawny* eye-ring; feet and upper mandible brown, under mandible pale. In midsummer, rather darker; in early fall brighter and especially more yellowish below; in the young, the wing-markings more fulvous, the general plumage slightly buffy-suffused; when very young, said to be mottled transversely with pale ochraceous. Largest: 5.75–6.25 — rather over than under 6.00; extent rather over than under 9.50; wing 2.75–3.00 (even 3.12); tail 2.50–2.75; bill nearly or quite 0.50, about 0.25 wide at nostrils, broad and flat, like a pewee's; tarsus 0.66; middle toe and claw 0.50; point of wing reaching nearly *an inch* beyond the secondaries; 2d, 3d, and 4th quills nearly equal and *much* ($\frac{1}{4}$ inch or more) longer than 1st and 5th, which about equal each other; 1st *much* longer than 6th. The ♀ near the lesser of all the dimensions given. Eastern U. S., southerly, *scarcely known in New England;* abundant in the Middle and Western *States* in woodland; readily recognized by the points of size and shape, without regarding coloration. Nest in trees, in horizontal fork of a slender bough; thin and open-worked, shallow, flat, saucer-shaped; eggs 2–4, 0.78 × 0.56, creamy-white, boldly spotted, resembling a wood pewee's. (*Muscicapa subviridis* BARTRAM, 1791; *Empidonax* **subviridis** COUES, 1882 (name *acadicus* geographically false). *Muscicapa querula* WILS., ii, 77, pl. 13, f. 3; *M. acadica* AUD., B. Am., 8vo. ed. 1840, i, 221, pl. 62; *Empidonax acadicus* BD., B. N. A., 1858, p. 197.)

385. E. trailli. (To T. S. Traill, of Edinburgh.) TRAILL'S FLYCATCHER. Above, olive-*brown*, lighter and duller brownish posteriorly, darker on head, owing to obviously dusky centres of the coronal feathers; below, nearly as in *acadicus*, but *darker*, the olive-gray shading quite across the breast; wing-markings *grayish-white* with slight yellowish or tawny shade; under mandible pale; upper mandible and feet black. Averaging smaller than *acadicus;* length 5.50–6.00; extent under 9.50, usually 8.75–9.00; wing 2.66–2.75, more rounded than in *acadicus*, its tip only reaching about $\frac{2}{3}$ of an inch beyond the secondaries, formed by 2d, 3d and 4th quills, as before, but 5th not so much shorter (hardly or not $\frac{1}{4}$ of an inch), the 1st ranging between 5th and 6th; tail 2.50; tarsus 0.66, as before, but middle toe and claw 0.60, the feet thus differently proportioned, owing to length of toes; bill not so broad and flat as in *acadicus*. Eastern N. Am. to the Plains, common; an entirely different bird from *acadicus*, but difficult if not impossible to distinguish from the following variety; almost the same in *color* as *minimus*, but larger, and otherwise perfectly distinct. A common breeder from New England and Canada

to Dakota and Missouri; migrating through all the E. U. S., wintering beyond. Nest in trees or bushes, usually the latter, in New England at any rate; nest in an upright crotch, thick-walled, deeply-cupped, more or less compact-walled, sometimes slovenly and resembling that of an Indigo-bird; in any case different entirely from the flat pewee-like saucer of *acadicus;* eggs not distinguishable from those of *acadicus*, though averaging smaller; very different from those of *minimus*. Note a flat *ke'-wink ke'-wink*, slowly.

386. **E. pusil'lus.** (Lat. *pusillus*, puerile, petty.) LITTLE WESTERN FLYCATCHER. Replaces true *trailli* from the Plains to the Pacific; may usually be recognized by its more fuscous coloration, the olivaceous and yellowish shades of *trailli* being subdued; by its larger bill, and the feet nearly as in *acadicus*. But are not specimens absolutely like *trailli* found in the West? The original *Tyrannula pusilla* of SW., Fn. Bor.-Am., ii, 1831, 144; AUD., B. Am., 8vo. ed. ii, 1840, 236, pl. 66, is uncertain, just as likely have been *minimus* as this bird. I therefore pass over the name, which, if belonging here, antedates *trailli*, and adopt *trailli* for the eastern form (although Audubon says "Arkansas to the Columbia"), taking *pusillus* of Baird for the Western variety. This is the usual "little flycatcher" in Western woodland, generally distributed. Habits, nest and eggs counterparts of those of *trailli*.

387 **E. mi'nimus.** (Lat. *minimus*, smallest.) LEAST FLYCATCHER. Colors almost exactly as in *trailli;* usually, however, olive-*gray* rather than olive-brown; the wing-markings, eye-ring and loral feathers plain grayish-*white;* the whole anterior parts often with a slight *ashy* cast; under mandible ordinarily dusky; feet perfectly black. It is a smaller bird than *trailli*, and not so stoutly built; the wing-tip projects only about half an inch beyond the secondaries; the 5th quill is but very little shorter than the 4th, the 1st apt to be nearer 6th than 5th; the feet are differently proportioned, being much as in *acadicus;* the bill is obviously under half an inch long. Length 5.00–5.50; extent about 8.00; wing 2.60 *or less;* tail about 2.25. A series of ♂ ♂, measured fresh, runs 5.20–5.50 long, by 7.60–8.30 in extent; several ♀ ♀ are 4.80–5.10 long, by 7.40–7.90 in extent. Although a large ♂ may grade up to ♀ *trailli* in size, and there is no *obviously* different coloration, it is a different bird. Eastern N. Am. to the Plains, very abundant in the U. S. during the migrations, in orchards, coppices, hedgerows, and the skirts of woods rather than in heavy forests. The commonest breeder in New England, especially Massachusetts; very common along Red River of the North, breeding at 49°. Ranges through E. U. S. in migration; winters extralimital. Nest in *upright* crotch of tree, shrub, or sapling; small, neat, compact-walled, deeply-cupped; eggs 3–4, *white*, normally *unmarked*, *rarely* speckled, 0.60–0.69 long, averaging 0.65 × 0.51. Note a sharp *che-bec'*, or *se-wick'*, quickly.

388. **E. flaviven'tris.** (Lat. *flavus*, yellow, *ventris*, of the belly.) YELLOW-BELLIED FLYCATCHER. Above, olive-*green*, *clear*, continuous and uniform as in *acadicus*, or even brighter; below, not merely yellow*ish*, as in the foregoing, but emphatically *yellow*, bright and pure on the belly, shaded on the sides and anteriorly with a paler tint of the color of the back; eye-ring and wing-markings *yellow;* under mandible yellow; feet black. In respect of color, this species differs materially from all the rest; none of them, even at their autumnal yellow*est*, quite match it. Size of *trailli*, or rather less; feet proportioned as in *acadicus;* bill nearly as in *minimus*, but rather larger; 1st quill usually equal to 6th. Eastern U. S. and British Provinces, common, in woodland, swamps and shrubbery. Breeds probably from the Middle States northward. There has been much misunderstanding about the nest and eggs of this bird; the latter are described by Brewer and by Coues (1874) as white. Nest in swamps, *close to ground*, in a stump, log, or roots of an upturned tree, thick and bulky, of mosses, etc., deeply cupped; *eggs spotted*. Note a low soft *pe-a*, slowly.

389. **E. f. diffi'cilis?** (Lat. *difficilis*, *dis-facilis*, difficult, un-doable; very appropriate!) WESTERN YELLOW-BELLIED FLYCATCHER. Not tangibly distinct from *flaviventris;* coloration dingy, instead of pure olivaceous and yellow, the latter dulled with an ochrey shade; tail said to be longer. Western U. S., abundant. Eggs speckled.

390. **E. ham'mondi.** (To Dr. W. A. Hammond, U. S. A.) HAMMOND'S FLYCATCHER. DIRTY LITTLE FLYCATCHER. Above, olive-*gray*, decidedly grayer or even ashy on the fore-parts; the whole throat and *breast* almost continuously *olive-gray* but little paler than the back, the belly alone more or less decidedly yellowish; wing-markings and eye-ring dull soiled whitish; bill *very small*, and extremely *narrow*, being hardly or not 0.20 wide at the nostrils; this distinguishes the bird from all but *minimus* and *obscurus;* under mandible usually blackish; tail usually decidedly *forked*, more so than in other species (though in all of them it varies from slightly rounded to slightly emarginate); outer tail-feather usually whitish-*edged* externally (a character often shown by *trailli* and *minimus*), but *not* decidedly *white*. About the size of *minimus;* wings and tail relatively longer. Plains to the Pacific, U. S., and British Am. This is the Western representative of *minimus*, but is tangibly distinct; the general tone of coloration is *heavy*, fall specimens in particular giving somewhat the effect of a dirty *flaviventris;* the tiny bill is a good mark. Nesting substantially like *minimus;* eggs *white, unmarked.* Note "a soft *pit.*"

391. **E. obscu'rus.** (Lat. *obscurus*, dark.) WRIGHT'S FLYCATCHER. GRAY LITTLE FLYCATCHER. Colors not very tangibly different from those of *trailli* or *minimus*, but *outer web* of outer tail-feather abruptly *white* in decided contrast. General tone quite *gray;* gray below quite across breast, giving the effect there of *Contopus richardsoni;* under mandible obscured; eye-ring and wing-edgings quite whitish. General dimensions approaching those of *acadicus*, owing to length of wings and tail. Length doubtless up to 6.00, and extent to 9.50; wing 2.66–3.00; tail 2.50–2.75; tarsi about 0.75; bill about 0.50, *extremely narrow* (much as in *Sayiornis fusca*), its width at the nostrils only about ½ its length. The bird looks singularly like the Western *Contopus*, though of course immediately seen to be *Empidonax*. Rocky and other mts. of the West, N. to 49°, in woodland, groves and thickets. To complete the analogies between the Eastern and Western *Empidonaces*, this may be considered to represent *acadicus*. Nesting, however, substantially as in *minimus:* a neat, compact, deep-cupped nest in crotch of a sapling, and eggs 3–4, *white, unmarked*, but large, 0.75 × 0.58. Note "a weird *sweer*," "a soft liquid *whit.*" (*E. obscurus, E. wrightii*, BAIRD, 1858; but qu. *Tyr. obscura* SW. 1827?)

124. **MITRE'PHANES.** (Gr. *μίτρη, mitre*, a head-dress; *φαίνω*, I appear.) LITTLE BUFF FLYCATCHERS. Coronal feathers and rictal bristles longer than in *Empidonax*, and general cast of the plumage buffy or fulvous rather than olivaceous; otherwise (our species at any rate) not different from *Empidonax*. Several Mexican species, one reaching our border. (*Mitrephanes* COUES, 1882, *vice Mitrephorus* SCL., 1859, preoccupied.)

392. **M. ful'vifrons palles'cens.** (Lat. *fulvifrons*, fulvous-fronted; *pallescens*, growing pale.) LITTLE BUFF-BREASTED FLYCATCHER. Above, dull grayish-brown tinged with olive, particularly on the back; below, pale fulvous, strongest across the breast, whitening on the belly; no fulvous on the forehead; sides of head light brownish-olive; wings and tail dusky, outer web of outer tail-feathers, edges of inner primaries except at the base, and tips of wing-coverts, whitish; iris brown; bill yellow below, black above; feet black. Length 4.75; extent 7.33; wing 2.12; tail 2.00; tarsus 0.55; middle toe and claw 0.45; bill 0.40. New Mexico, Arizona, and southward. (*Empidonax pygmæus* COUES, Ibis, 1865, p. 537; *Mitrephorus pallescens* COUES, Proc. Phila. Acad., 1866, p. 63. My original specimens, affording the descriptions quoted, and the first known to have been taken in the United States, do not appear to be specifically distinct from *Muscicapa fulvifrons* of GIRAUD (B. of Tex., 1841, pl. 2, f. 2); they are clean spring birds, and the species is more fulvous in fall plumage.)

125. **ORNITH'IUM.** (Gr. *ὀρνίθιον, ornithion*, dimin. of *ὄρνις*, a bird.) BEARDLESS FLYCATCHERS. General aspect of *Empidonax*, but remarkably distinguished by the *parine* shape of the bill, and almost entire absence of the rictal bristles so conspicuous in most genera of *Tyrannidæ*, though a few slight ones may be seen on close inspection. Bill much shorter than head, stout, *compressed*, not depressed as usual in *Tyrannidæ*, with high-ridged arched culmen and scarcely

overhanging tip; commissure gently incurved; gonys about straight. Head a little crested, as in *Empidonax*, *Contopus*, etc. Wings of moderate length, much rounded; 2d to 5th primaries subequal and longest, 6th shorter, 1st about equal to 7th. Tail a little shorter than wings, even or scarcely rounded. Tarsus long, exceeding the middle toe and claw; lateral toes subequal, their claws about reaching base of middle claw; hind claw shorter than its digit. Of diminutive size, and dull plain colors, as in the small olivaceous flycatchers generally; but for the bill, the species might be mistaken for an *Empidonax*.

393. **O. imber'be.** (Lat. *imberbis*, beardless; *in*, not, and *barba*, a beard.) TEXAS BEARDLESS FLYCATCHER. Adult ♂ ♀: Above, dull olive-gray, a little darker (browner) on the lengthened erectile feathers of the crown, a little brighter (greener) on the rump and upper tail-coverts. Below, pale dull gray, sometimes almost grayish-white anteriorly, clearing on the belly and under tail-coverts to pale yellowish. Wings and tail fuscous, with pale gray or whitish edgings of the middle and greater coverts and most of the quills of the wings, as in an *Empidonax*. Bill dark brown above, pale below. Worn specimens are quite brownish above, and whitish below, with little edging of the wings and tail. Young and fresh fall specimens are more clearly olivaceous above and yellowish below, shaded with gray across the breast; the young with the wing-bars tinged with buff or tawny — all quite as usual in *Empidonax*. Very small: length about 4.25; wing 2.10; tail 1.80; bill scarcely 0.30; tarsus 0.55; whole foot scarcely 1.00. A curious little flycatcher of Mexico and Central Am., lately discovered on the Lower Rio Grande of Texas. Nest and eggs unknown.

126. **PYROCE'PHALUS.** (Gr. πῦρ, gen. πυρός, *pur*, *puros*, fire; κεφαλή, *kephale*, head.) FIRE-CROWNED FLYCATCHERS. Sexes very dissimilar: head of ♂ with a full globular crest (fig. 288), and all under parts (usually) scarlet-red; other parts deep brown; ♀ brown and whitish. Bill slender, narrow at base, much as in *Sayiornis*. Wings moderate, pointed; 2d–4th quills longest, 1st between 5th and 6th. Tail nearly even, shorter than wings, of broad feathers. Tarsus scarcely longer than middle toe and claw. A tropical genus of several species, one of which reaches our border.

394. **P. rubi'neus mexica'nus.** (Lat. *rubineus*, ruby-red.) VERMILION FLYCATCHER. Adult ♂: Pure dark brown, including stripe along side of head; wings and tail blackish with slight pale edgings; the full globular crest, and all the under parts scarlet or vermilion; bill and feet black. ♀: Dull brown, including the little-crested crown; below, white, tinged with red, reddish or orange in some places; the breast and sides with slight dusky streaks. Immature ♂ shows gradation between the characters of both sexes: at first there is no red whatever, the bird otherwise resembling the ♀, but pale yellowish where she is reddish; upper parts gray; all the feathers may be skirted with whitish, especially on the wing-coverts and inner secondaries; tail quite blackish; under parts more purely white than in the ♀, and rather speckled than streaked with gray. But reddish soon replaces the yellow of the crissum and axillars. Adult ♂ ♂ are subject to much variation: the red is sometimes rather orange. Length about 6.00; wing 3.25; tail 2.50; bill 0.45; tarsus 0.55; middle toe and claw 0.50. Valleys of the Rio Grande and Colorado, and southward; common in Arizona on the Gila; a very showy little bird, of the usual flycatcher habits.

FIG. 288. — Head of Vermilion Flycatcher, nat. size.

II. — Order PICARIÆ: Picarian Birds.

This is a miscellaneous assortment (in scientific language, "a polymorphic group") of birds of highly diversified forms, grouped together more because they differ from other birds in one way or another, than on account of their resemblance to one another. As commonly received,

this order includes all the non-passerine Land Birds down to those with a cered bill (parrots and birds of prey). Excluding the parrots, which constitute a strongly marked natural group, of equal value with those called orders in this work, the *Picariæ* correspond to the *Strisores* + *Scansores* of authors; including, however, some that are often referred to *Clamatores*. (This "order" *Scansores*, or *Zygodactyli*, containing all the birds that have the toes arranged in pairs, two in front and two behind (and some that have not), is one of the most unmitigated inflictions that ornithology has suffered; it is as thoroughly unnatural as the divisions of my artificial key to our genera.) I have no faith whatever in the integrity of any such grouping as "Picariæ" implies; but if I should break up this conventional assemblage, I should not know what to do with the fragments; not being prepared to follow Garrod to the length of a classification of birds based primarily upon the condition of certain muscles of the leg; and knowing of no available alternative. With this protest, and upon such understanding, I retain the Picarian group, as in the original edition of the Key, to include all the N. A. Land Birds of non-passerine character, without a hooked and cered bill, and without the proper characters of the Columbine and Galline families.

Manifestly, from what has been said, the *Picariæ* are insusceptible of satisfactory definition; but I may indicate some leading features, mostly of a negative character, that they possess in common. The sternum rarely conforms to the particular Passerine model, its posterior border usually being either entire or else doubly-notched. The vocal apparatus is not highly developed, having not more than three pairs of separate intrinsic muscles; the birds, consequently, are never highly musical. There are some modifications of the cranial bones not observed in *Passeres*. According to Sundevall, the *Picariæ*, like lower birds, usually lack a certain specialization of the flexor muscles of the toes seen in *Passeres*. The feet are very variously modified; one or another of all the toes, except the middle one, is susceptible of being turned, in this or that case, in an opposite from the customary direction; the fourth one being frequently capable of turning either way; while in two genera (of *Picidæ* the first, and in two others (of *Alcedinidæ*) the second, toe is deficient. The tarsal envelope is never entire behind, as in the higher *Passeres*. Another curious peculiarity of the feet is, that the claw of the hind toe is smaller, or at most not larger, than that of the third toe; and on the whole the hind toe itself is inconsiderable, weak if not wanting, not always perfectly incumbent and apposable. The wings, endlessly varied in shape, agree in possessing ten developed primaries, of which the first is rarely spurious or very short. (A notable exception to this occurs in the *Pici*.) A very general and useful wing-character is, that the coverts are larger and in more numerous series than in *Passeres;* the greater coverts being at least half as long as the secondary quills they cover, and sometimes reaching nearly to the ends of these quills. This is the common case among lower birds, but it distinguishes most of the *Picariæ* from *Passeres;* it is not shown, however, in the *Picidæ* and some others. The tail is indefinitely varied in shape, but the number of its feathers is a good clue to *Picariæ*. There are not ordinarily more than *ten* perfect rectrices, and occasionally there are only eight; the Woodpeckers have twelve, but one pair is abortive; there are twelve, however, in the Kingfishers, and some others. The bill shows numberless modifications in form, and has its own specialization in nearly every family; it assumes some of the most extraordinary shapes, as in the hornbills and toucans, and is seldom of the simple style seen in a thrush or finch; it is never hooked and cered as in parrots and birds of prey, nor soft and swollen at the nostrils, as in pigeons.

With this slight sketch of some leading features of the group (it will enable the student to recognize any Picarian bird of this country at least, and that is my main object), I pass to the consideration of its subdivision, with the remark that a precedent may be found for any conceivable grouping of the families that is not perfectly preposterous, and for some arrangements that are nearly so. As well as I can judge from the material at my command, and relying upon authority for data that I lack, the *Picariæ* fall into three divisions at least. These I shall call

suborders, not however insisting in the least upon the question of taxonomic rank, but simply employing the terms conformably with my usage in other cases. The three groups may be here tabulated, with remarks calculated to give an idea of their composition : —

I. CYPSELIFORMES — including only the three families *Cypselidæ*, *Caprimulgidæ*, and *Trochilidæ* — the Swifts, Goatsuckers, and Humming-birds. They are birds of remarkable volitorial powers ; the wing is pointed, and very long in its feathers and terminal portions, though the upper arm is very short. The feet are extremely small and weak, and are scarcely if at all serviceable for progression. The hind toe is sometimes versatile (among the Swifts) or somewhat elevated (in the Goatsuckers and some Swifts) ; the front toes are frequently connected at base by movable webbing (Goatsuckers), and sometimes lack the normal number of phalanges (among Swifts and Goatsuckers) ; but the feet are never zygodactyle nor syndactyle. The variously-shaped tail has ten rectrices. One family (Humming-birds) shows the *tenuirostral* type of bill ; the other two, the *fissirostral*, on which account they used to be classed with the Swallows. The sternum is broad, with a deep keel, entire or doubly notched (rarely singly notched) behind. The syrinx has not more than one pair of intrinsic muscles.

II. CUCULIFORMES * — comprehending the great bulk of the order ; in all, about fifteen families, rather more than less. They are only readily limited by exclusion of the characters of the preceding and following groups. The sternum is usually notched behind ; the syringeal muscles are two pairs at most. The feet are *generally* short ; the disposition of the toes varies remarkably. In the *Coliidæ*, or colies, of Africa, all the toes are turned forward. In the *Trogonidæ*, the second toe is turned backward, so that the birds are zygodactyle, but in a different way from all others. Families with the feet permanently zygodactyle in the ordinary way by reversion of the fourth, or partially so, the outer toe being versatile, are — the *Cuculidæ*, or Cuckoos, with their near relatives the *Indicatoridæ* or Guide-birds of Africa ; the *Rhamphastidæ*, or Toucans, confined to tropical America and distinguished by their enormous vaulted bill ; the *Musophagidæ*, Plaintain-eaters or Touracos, of Africa ; the *Bucconidæ* and *Capitonidæ*, or fissirostral and scansorial Barbets of the New and chiefly of Old World respectively ; and the *Galbulidæ*, or Jacamars, of America. (The *Cuculidæ* and *Musophagidæ* are by Garrod placed together with Gallinaceous birds.) In the remaining groups, the toes have the ordinary position, but sometimes offer unusual characters in other respects. Thus in the *Alcedinidæ* (Kingfishers), and *Momotidæ* (Motmots or Sawbills), the middle and outer toes are perfectly coherent for a great distance, constituting the *syngenesious*, *syndactyle* or *anisodactyle* foot. The *Bucerotidæ*, or Hornbills, of the Old World, characterized by an immense corneous process on the bill, are relatives of the Kingfishers ; so are the *Todidæ*, a group of small brightly-colored birds of Mexico and the West Indies. Other forms, all Old World, are the *Meropidæ* or bee-eaters, the *Upupidæ* or Hoopoes, and the *Coraciidæ* or Rollers, with their allies the *Leptosomatidæ*, of Madagascar.

III. PICIFORMES — comprising only three families, the *Iyngidæ*, or Wrynecks, with one genus and four species, of Europe, Asia, and Africa ; the *Picumnidæ*, with one or two genera and nearly thirty species, chiefly American ; and the *Picidæ* or true Woodpeckers. The digits are permanently paired by reversion of the fourth, except in two tridactyle genera, having no hind toe proper ; there is a modification of the

* While the *Cypseliformes* and *Piciformes* are each of them well characterized and perfectly defined groups of birds, the reverse is the case with the *Cuculiformes*, — a mixed lot requiring to be reconstructed by exclusion of some of the families here given as entering into its composition. The *Trogonidæ* have already been eliminated by Sclater under the name of *Heterodactyli*.

lower end of the metatarsus, corresponding to the reversed position of the fourth toe, and the upper part of the same bone is perforated by canals for flexor tendons. The basal phalanges of the toes are short. The wing has 10 primaries, and short secondary coverts (contrary to the rule in *Picariæ*); the tail 10 rectrices, soft and rounded in *Iyngidæ* and *Picumnidæ*, rigid and acuminate in *Picidæ*, where also a supplementary pair of spurious feathers is developed, making 12 in all. The nostrils vary: they are large and of peculiar structure in *Iyngidæ*, usually covered with antrorse plumules in the rest. The bill is straight or nearly so, hard and strong, acute or truncate, the mandibles equal; the tongue is lumbriciform, and very generally extensile to a remarkable degree, by a singular elongation of the bones and muscles (figs. 73, 74). The structure of the bony palate is unique among birds; it is called *saurognathous* by Parker (see p. 173). The salivary glands have an unusual development, in the typical species at any rate. The sternum is doubly-notched behind. A very strongly-marked group; in some respects it approaches the *Passerine* birds more nearly than other *Picariæ* do.

However impossible it is to define any such group as the conventional *Picariæ*, and however difficult it may be to make three or any other small number of subdivisions, the very diversity of the forms enables us to define *the families* with ease. The student can never be in doubt to which one of the six North American *families* his specimen belongs.

3. Suborder CYPSELIFORMES: Cypseliform Birds.

Fissirostral (*Caprimulgidæ*, *Cypselidæ*) *or tenuirostral* (*Trochilidæ*) *Picariæ.* Wings lengthened in the distal joints, shortened in the proximal, with 10 fully-developed primaries; making an instrument of remarkable power. Feet never zygodactyle nor syndactyle; small, weak, scarcely fitted for progression; hind toe often elevated or versatile; front toes often webbed at base, or with abnormal ratio of phalanges, or both these modifications together (figs. 40, 41). Tail of 10 rectrices. Palate ægithognathous (p. 172). Sternum deep-keeled, its posterior border usually entire, or doubly-notched or fenestrate. Syringeal muscles not more than one pair. The oil-gland nude. No cœca in *Cypselidæ* and *Trochilidæ;* cœca present in *Caprimulgidæ.* Anomalogonatous; no ambiens nor accessory femoro-caudal muscle.

Contains the 3 families named above, — *Goatsuckers*, *Swifts*, and *Humming-birds.* Notwithstanding the peculiarities of the latter, especially their long slender bill, they are really more nearly related to the fissirostral Swifts than these are to the fissirostral *Caprimulgidæ*, in essential structural characters.

21. Family CAPRIMULGIDÆ: Goatsuckers

Fig. 289. — Whippoorwill, a setirostral Caprimulgine. (From Tenney, after Wilson.)

(So called from a traditional superstition). *Fissirostral Picariæ.* Head broad, flattened; neck inappreciable; eyes and ears large. Bill extremely small in its horny portion, which is depressed, and triangular when viewed from above, but with enormous gape reaching below the eye, and generally with bristles attaining an extraordinary development. Nostrils basal, exposed, roundish, with a raised border, sometimes prolonged into a tube. Wings more or less lengthened and pointed, deriving their sweep mainly from elongation of the distal joints and the feathers, the proximal segment being short; of 10 primaries and more than 9 secondaries; the latter not so extremely short as in *Cypselidæ.* Tail variable in shape, of 10

rectrices. In certain genera, either wing or tail develops a pair of immensely lengthened feathers. Feet extremely small; tarsus usually short, and partly feathered; hind toe very short, commonly elevated and turned sideways; front toes connected at base by movable webbing, and frequently showing abnormal ratio or phalanges, the 4th toe having but 4 joints (p. 127, fig. 41); middle toe lengthened beyond the short lateral ones, its claw usually pectinate (fig. 291). The oil-gland is nude, and cœca are present. The arrangement of the leg-muscles is anomalogonatous (p. 195); the ambiens and accessory femoro-caudal are both absent.

A definitely-circumscribed, easily-recognized group of about 14 genera and rather more than 100 species, of temperate and tropical parts of both hemispheres. They are all more or less nocturnal, and have a certain resemblance to owls, — particularly the genus *Steatornis*, which is quite owlish. The flight is perfectly noiseless; the plumage is very soft and lax, as in owls, and the colors are usually blended in the most intricate pattern. The *Caprimulgidæ* are divisible, according to the structure of the feet, into two subfamilies: *Podarginæ*, chiefly Old World, with the normal ratio of phalanges, and *Caprimulginæ* (as below). Considering, however, other points, particularly the shape of the sternum, a more elaborate division is into (1) *Podarginæ*, phalanges normal, tarsus naked and lengthened, sternum doubly-notched, with three genera (*Podargus*, *Batrachostomus*, and *Ægotheles* of the Old World; (2) *Nyctibiinæ*, phalanges normal, tarsus short, feathered, sternum doubly-notched, upper mandible toothed, containing one genus (*Nyctibius*) of tropical America; (3) *Steatornithinæ*, phalanges normal, sternum singly-notched, with one remarkable genus (*Steatornis*) of tropical America, which might properly be made type of a separate family, so many are the peculiarities of this owlish bird; and finally (4) *Caprimulginæ*, comprising the rest of the family. The latter alone is represented in North America. Our "Whippoorwills" are typically caprimulgine, and give a good idea of the essential characters of the family; our "Night-hawks" are more aberrant, representing a particular section of the subfamily; but neither of these gives any hint of the singular shapes which some of the genera assume.

30. Subfamily CAPRIMULGINÆ: True Goatsuckers; Night-jars.

FIG. 290. — Night-hawk, a glabrirostral Caprimulgine. (From Tenney, after Wilson.)

Sternum singly-notched on each side behind; its body not square. Ratio of phalanges abnormal. *Outer toe 4-jointed; middle claw pectinate; hind toe very short, elevated, semi-lateral; anterior toes movably webbed at base* (fig. 41); lateral toes not nearly reaching base of middle claw. Tarsus very short, commonly much feathered (longer and naked in *Nyctidromus* and *Phalænoptilus*). Besides the semipalmation of the feet, there is another curious analogy to wading birds; for the young are downy at birth, as in *Præcoces*, instead of naked, as is the rule among *Altrices*. The plumage is soft and lax, much as in the Owls; the birds have the same noiseless flight, as well as, in most cases, nocturnal or crepuscular habits; and some of them bear an odd resemblance to Owls. Besides this fluffiness and laxity of the plumage, the skin is very thin and tender; it is difficult to make good specimens of the whippoorwills, and the curiously variegated blended shades, of exquisite beauty, like the powdery coloration of a moth's wings, are at best not easy to describe. An evident design of the capacious mouth is the capture of insects; the active birds quarter the air with wide-open mouth, and their minute prey is readily taken in. But they also secure larger insects in other ways; and to this end the rictus is frequently strongly bristled, as in the *Tyrannidæ*. In

all our genera excepting *Chordediles*, the rictal bristles are an inch or more in length, in a firm regular series along the gape — they are relatively longer and stiffer than the whiskers of a cat. Our several genera are readily discriminated by good characters of the nostrils, enormous rictal bristles, and comparatively short wings of the Night-jars proper, in comparison with the slight bristles, forked tail and long pointed wings of *Chordediles;* they respectively represent two sections of the subfamily — *Setirostres*, bristled-billed (fig. 289), and *Glabrirostres*, smooth-billed (fig. 290). In both the feet are so extremely short that the birds cannot perch in the usual way, but sit lengthwise on a large branch, or crouch on the ground. They lay two lengthened, white or thickly spotted eggs, on or near the ground, in stumps, etc. The sexes are distinguishable, but nearly alike. The voice is peculiar, and has given several of the species their fanciful onomatopoetic names. Migratory.

Obs. Since the orig. ed. of the Key was published, a fine genus and species, *Nyctidromus albicollis*, has been added to our Fauna. "Nuttall's Whippoorwill" has been made the type of a new genus, *Phalænoptilus*, on the ground of its naked feet, short square tail, and other good characters. The common whippoorwill has been referred back to the old genus *Caprimulgus*. While it certainly differs from the chuck-will's-widow, type of *Antrostomus*, in not having the rictal bristles garnished with lateral filaments, and is not very obviously different from *Caprimulgus* of the Old World, it may be best to keep it with *Antrostomus*, where all the New World species are usually referred, until the limits of the respective genera are better understood.

Analysis of Genera.

A. Setirostres. Long rictal bristles. Plumage very lax.
- Tarsus extensively feathered. Nostrils not extensively tubular.
  - Tail rounded, much shorter than wing. Primaries all mottled, without white spaces. Eggs colored. Large and medium-sized . . . . . *Antrostomus* 128
- Tarsus naked, except on joint above. Nostrils extensively tubular.
  - Tail square, much shorter than wing. Primaries all mottled, without white spaces. Eggs colorless. Small (Western.) . . . . . *Phalænoptilus* 129
  - Tail rounded, about as long as wing. Outer primaries mostly whole-colored, with great white spaces. Eggs colored. Very large (Southwestern.) . . . . . *Nyctidromus* 127

B. Glabrirostres. No long rictal bristles. Plumage more compact.
- Tarsus moderately feathered. Nostrils not extensively tubular.
  - Tail forked, much shorter than the pointed wing. Outer primaries mostly whole-colored, with great white spaces. Eggs colored. Medium-sized . . . . . *Chordediles* 130

127. **NYCTI'DROMUS.** (Gr. *νύξ*, gen. *νυκτός*, *nux*, *nuctos*, night; *δρόμος*, *dromos*, act of coursing. Fig. 291.) Night Coursers. Nostrils prolonged as cylindric tubes opening forward and outward. Rictal bristles immense, simple; other bristle-tipped or bristle-bearded feathers about the bill. Tarsus lengthened, but not exceeding the middle toe without claw, naked except just on the joint. Wing scarcely rounded; tipped by 2d, 3d, and 4th quills, 1st longer than 5th, folding to about the middle of the tail, which is rounded, and approximately of equal length with the wing. Plumage not so lax as in a whippoorwill; in this, as in the stiffish primaries with little marbling but great white spaces, and the under parts barred crosswise, is seen an approach to *Chordediles*, between which genus and *Phalænoptilus Nycti-*

Fig. 291. — Head, foot, and pectinated claw of *Nyctidromus*, nat. size. (Ad nat. del. R. Ridgway.)

dromus probably comes. One or two species, long well known in tropical America, lately found N. to Texas.

395. N. albicol'lis. (Lat. *albus*, white; *collum*, neck.) WHITE-THROATED NIGHT-COURSER. PAURAQUE. Adult ♂: Assuming brownish-gray as the ground color of the upper parts: Crown heavily dashed with black streaks along the middle line, with narrow black shaft-lines at the sides and on nape. Back more diffusely streaked with black in smaller pattern, tending to break up in chains of shaft-spots, and with lighter gray and brown marbling. Scapulars and tertiaries boldly and beautifully marked with firm, even, sharp lines of white or tawny-white — the arrow-headed edgings of angular black terminal fields. Wing-coverts curiously mottled with black, white, and tawny — the white and tawny conspicuous as large irregularly roundish spots. Five outer primaries with a large oblique white spot, on the 1st at about its middle, on the others nearing their ends; these primaries otherwise plain blackish, except a little marbling at their ends — the whole effect thus as in *Chordediles*. Other primaries and all the secondaries blackish, fully scalloped and barred with tawny in increasing amount and regularity from without inward. Four middle tail-feathers clouded with the same variegated colors as the other upper parts, but without definite white — the markings tending to wavy cross-bars. Next two lateral feathers on each side with great white spaces on one or both webs at end, 2–3 inches long, the rest of these feathers chiefly barred with black and tawny; outer feather chiefly black, but with marbling, and with white and tawny. Ear-coverts rich chestnut, well contrasted with surroundings. Throat with a broad white collar, some of the white feathers black-tipped. Under parts ochraceous or pale tawny, varied with whitish, and pretty regularly barred crosswise with blackish-brown, thus somewhat as in *Chordediles*. Length 13.00; extent 25.00: wing and tail, each, 7.50; tail graduated 1.00; tarsus 1.00; middle toe and claw 1.25. Another Texas specimen (perhaps ♀, but with even more white on the tail, but white on only 4 primaries) is much smaller: length about 10.50; wing 6.50; tail 6.00. The species is said to be very variable in size and markings; ♀ to have the collar buff. Tropical America, N. to Texas, where common in the valley of the Lower Rio Grande. Eggs 2, laid on the ground; 1.25 × 0.92, creamy-buff, spotted with pinkish, brown, and lilac.

128. ANTRO/STOMUS. (Gr. *ἄντρον*, *antron*, a cave; *στόμα*, *stoma*, mouth; alluding to the cavernous mouth. Fig. 292.) AMERICAN NIGHT-JARS. Nostrils oval, with a raised rim not prolonged as a tube, opening upward and outward. Rictal bristles immense, with or without lateral filaments, and other bristly or bristle-bearded feathers about the bill. Tarsus not longer than middle toe without claw, feathered in front nearly to the toes. Wing rounded, tipped by 2d and 3d quills, folding to beyond the middle of the tail, which is rounded (not enough so in fig. 293) and much shorter than wing. Plumage very lax, with minutely marbled coloration, in some places as if dusted or frosted over; primaries weak, all mottled with tawny, without great white spaces; under parts mottled, with little tendency to regular crosswise barring; markings of crown longitudinal. Size medium and rather large; sexes distinguishable; eggs 2, heavily colored. Highly nocturnal. Containing those shadowy birds, consorts of bats and owls, — those scarce-embodied voices of the night, here, there, and everywhere unseen, but shrilling on the ear with sorrow-stricken iteration.

FIG. 292. — Head and foot of Whippoorwill, nat. size. (Ad nat. del. R. Ridgway.)

Analysis of Species.

Large: rictal bristles garnished with lateral filaments. Tail with large whole-colored spaces in ♂ only (*Antrostomus* proper) . . . . . *carolinensis* 396

Small: rictal bristles simple. Tail with white spaces in both sexes (*Caprimulgus?*) . . . . *vociferus* 397

396. A. carolinen'sis. (Lat. Carolinian.) CHUCK-WILL'S-WIDOW. *The rictal bristles with lateral filaments.* Singularly variegated with black, white, brown, tawny, and rufous, the prevailing tone fulvous; a whitish or tawny throat-bar; several lateral tail-feathers with large whole-colored space in the ♂, all variegated in the ♀. Adult ♂: Taking dark wood-brown as the ground color of the upper parts, this is heavily dashed with black, lengthwise on the crown in large pattern, elsewhere similar in smaller style, everywhere minutely punctulated

FIG. 293. — Whippoorwill, ½ nat. size. (From Brehm. Tail not rounded enough.)

with ochrey and gray, as if dusted over; wing-coverts and inner quills more boldly varied with black centre-fields and tawny or whitish edgings of the feathers. Four middle tail-feathers singularly clouded with gray and tawny on a seeming black ground, the pattern tending cross-wise. All the other tail-feathers with the inner webs having 2–3 inch long whole-colored spaces, *white* viewed from above, *tawny* seen from below (a curious difference, which has caused some confusion in descriptions of the sexes of this bird); their outer webs mottled with black and tawny. Primaries black, fully mottled with broken-up tawny-reddish cross-bars. General tone of the under parts ochraceous, becoming quite so posteriorly, with pronounced tendency to black cross-waves. Length 11.00–12.00; extent about 25.00; wing 8.00 or more; tail 5.00 or more; whole foot 1.75. ♀ only differs in lacking the whole-colored spaces on the tail, all the feathers being motley throughout; primaries more closely mottled with reddish;

rather smaller. South Atlantic and Gulf States, Carolina to Indian Territory, Texas and N. Mexico, S. to Central America; resident on our southern border. Twice as bulky as a whip-poorwill, the general tone rufous. Eggs 2, 1.45 × 1.05, heavily marked in intricate pattern with browns and neutral tints.

397. A. voci/ferus. (Lat. *vociferus*, voice-bearing. Figs. 289, 292, 293.) WHIPPOORWILL. NIGHT-JAR. *The rictal bristles simple.* Upper parts variegated with gray, black, whitish, and tawny; prevailing tone gray; black streaks sharp on the head and back, the colors elsewhere delicately marbled, including the four median tail-feathers; wings and their coverts with bars of rufous spots; lateral tail-feathers black, with large white (♂) or small tawny (♀) terminal spaces; a white (♂) or tawny (♀) throat-bar. Adult ♂: Assuming stone-gray as the ground-color of the upper parts: Crown with a purplish cast, heavily dashed lengthwise with black; back darker, with smaller streaks; tail beautifully marbled with slate-gray and black tending crosswise on the 4 middle feathers; scapulars with bold black centre-fields set in frosty marbling; hind neck with white specks, as if continued around from the white throat-bar. Primaries black, with a little marbling at their ends, fully broken-barred with tawny-reddish; no white spaces. Three lateral tail-feathers mostly black, with pure white terminal spaces 1–2 inches long. Under parts quite blackish, on the breast powdered over with hoary-gray, more posteriorly marbled with gray and tawny, tending crosswise. Lores and ear-coverts dark brown. It is only in perfect plumage that the colors are as slaty and frosty as described; ordinarily more brown and ochrey. Length 9.00–10.00; extent 16.00–18.00; wing 6.00 or more; tail 5.00 or less; whole foot 1.40; the distance across from one corner of the mouth to the other about as much as length of gape. ♀, adult: General tone more brownish and ochrey; throat-bar tawny-whitish; tail-spaces very slight and ochraceous; rather smaller. Eastern U. S. and British Provinces to the central plains, abundant, migratory; breeds throughout, but chiefly northerly; winters beyond. A shady character, oftener heard than seen, of recluse nocturnal habits and perfectly noiseless flight, in the breeding season ceaseless in uttering its strange uncouth cries with startling vehemence. The notes are likened to the phrase which has given the name; they are very rapidly reiterated, with strong accent on the last syllable; when very near, a clicking sound, and sometimes low murmuring tones, may also be heard. No nest; 2 eggs on ground or log or stump, 1.25 × 0.90, creamy-white, heavily marked with browns and neutral tints. The young are helpless, shapeless, downy masses; both eggs and young are often removed in the parent's mouth if disturbed, as a cat carries off her kittens, — a practice, however, habitual in this curious family of birds. Unlike the night-hawk, the whip-poorwill rarely flies by day, unless flushed from its shady retreats.

881. (addenda) **A. v. arizo/næ.** ARIZONA WHIPPOORWILL. Similar: larger: rictal bristles longer. ♂: Throat-bar and superciliary streak ochraceous; lores and ear-coverts tawny; white spaces on tail short; under tail-coverts nearly unbarred. Length 10.20; extent 19.40; wing 6.65; tail 4.45; longest rictal bristle 1.80; longest tail-spot 1.55. Arizona. Perhaps approaching *A. macromystax.*

129. PHALÆNO/PTILUS. (Gr. *φάλαινα*, *phalaina*, a moth; *πτίλον*, *ptilon*, feather: alluding to the powdery plumage, like the furriness of a moth's wings. Fig. 294.) POOR-WILLS. Nostrils tubular, cylindric, opening forward and outward. Rictal bristles immense, but simple. Tarsus naked except just on the joint above (as in *Nyctidromus*), as long as middle toe without claw. Tail square, much shorter than the rounded wings, which fold nearly to its end. Plumage peculiarly soft and velvety, in hoar-

FIG. 294. — Head and foot of Nuttall's Poor-will, nat. size. (Ad nat. del. R. Ridgway.)

frosted pattern of coloration. Markings of crown transverse; primaries barred with black and tawny. Size small. Sexes alike. Note dissyllabic. Eggs white.

398. P. nut'talli. (To Thos. Nuttall.) NUTTALL'S POOR-WILL. ♂ ♀, adult: Assuming the upper parts of a beautiful bronzy-gray ground color, this is elegantly frosted over with soft silver-gray, and watered in wavy cross-pattern with black, these black double crescents enlarging to herring-bone marks on the scapulars and inner quills. Four middle tail-feathers patterned after the back; others with firmer black bars on motley brown ground, and short white tips. Primaries and longer secondaries bright tawny, with pretty regular black bars, and marbled tips (the half-opened wing viewed from below is curiously like that of the short-eared owl.) A large firm silky-white throat-bar. Under parts grounded in blackish-brown, giving way behind through ochrey with dark bars to nearly uniform ochrey. It is impossible in words to give an idea of the artistic blending of the colors in this elegant little night-jar. The sexes

FIG. 295. — Night-hawk, or Bull-bat, ⅓ nat. size. (From Brehm. Bill too bristly.)

scarcely differ; specimens before me marked ♀ have as purely white throat as the ♂, but the tail-tips are shorter and tinged with tawny. Length 7.00–8.00; extent 15.00; wing about 5.50; tail 3.50 or less; tarsus, or middle toe without claw, 0.65. Plains to the Pacific, U. S. and southward, abundant. Note of two syllables, the first of the "whippoorwill" omitted. Eggs 2, 1.05 × 0.80, elliptical, *white*.

130. CHORDEDI'LES. (Gr. χορδή, *chorde*, a stringed musical instrument; δείλη, evening: alluding to the crepuscular habits.) NIGHT-HAWKS. Glabrirostral: the rictus without long stiff bristles. Horny part of beak extremely small. Nostrils cylindric and rimmed about, hardly tubular, opening outward and upward. Tarsus feathered part way down in front. Tail lightly forked, much shorter than the extremely long, pointed, stiff, and thin-bladed wing, with 1st primary as long as the next. Plumage more compact and smooth than in the night-jars; primaries mostly whole-colored (in *C. texensis* spotted), with large white (or tawny) spaces on the outer 4–6; under parts barred across; a large white (or tawny) V-shaped throat-bar. Eggs 2, heavily colored. Not strictly nocturnal. Remarkably volitorial.

Analysis of Species.

Large: wing near 8.00. Primaries dusky, with large white spot on 5 of them, in both sexes, about half way from bend to point of the wing . . . . . *popetue* 399, 400, 401

Small: wing about 7.00. Primaries more or less spotted with tawny, with large white (♂) or tawny (♀) spaces on 4 of them nearer point than bend of the wing. (Southwestern.) . . . . . *texensis* 402

399. C. popetue. (Vox barb., incog. Figs. 290, 295.) NIGHT-HAWK. BULL-BAT. Above, mottled with black, brown, gray and tawny, the former in excess; below from the breast transversely barred with blackish and white or pale fulvous; throat with a large white (♂) or tawny (♀) cross-bar; tail blackish, with distant pale marbled cross-bars and a large white spot (wanting in the ♀) on one or both webs of nearly all the feathers toward the end; primaries dusky, unmarked except by one large white spot on outer *five*, about midway between their base and tip; secondaries like primaries, but with whitish tips and imperfect cross-bars. Sexes nearly alike: ♀ with the white spaces on the quills, but that on the tail replaced by tawny or not evident. Young similar, with the wing-spots from the nest, but the markings finer and more intricately blended, in effect more like *Antrostomus;* quills edged and tipped with tawny. Length 9.00 or more; extent about 23.00; wing about 8.00; tail 4.50; whole foot 1.25; culmen scarcely 0.25; gape about 1.25. Temperate N. Am., chiefly Eastern, abundant; migratory; breeds throughout its range; winters beyond. This species flies abroad at all times, though it is perhaps most active towards evening and in dull weather; and is generally seen in companies, busily foraging for insects with rapid, easy, and protracted flight; in the breeding season it performs curious evolutions, falling through the air with a loud booming sound. Eggs 2, elliptical, 1.52 × 0.87, finely variegated with stone-gray and other neutral tints, over which is scratched and fretted dark olive-gray; but the pattern and tints are very variable. The young hatch covered with fluffy down, whitish below, varied with blackish and brown above. It may be necessary in this family for the young to be covered from the first, to protect them from the cold ground. On being disturbed while brooding the female feigns lameness, dragging and fluttering about, moaning piteously, and will sometimes remove her young.

400. C. p. hen′ryi. (To Dr. T. C. Henry.) WESTERN NIGHT-HAWK. The lighter-colored form prevailing in the dryer or unwooded portions of western United States; the gray and fulvous in excess of the darker hues, the white patches on the wing, tail and throat usually larger; the under tail-coverts more nearly uniform; but no specific character can be assigned.

401. C. p. mi′nor. (Lat. *minor*, smaller.) CUBAN NIGHT-HAWK. A form found in the West Indies, similar to *C. popetue* in color, but rather more tawny, and decidedly smaller: wing 7.00; tail 4.00. Florida.

402. C. acutipen′nis texen′sis. (Lat. *acutus*, acute; *penna*, a feather: alluding to the sharp-pointed wings. Of Texas: our bird a northern race of the S. Am. species.) TEXAS NIGHT-HAWK. Smaller than the foregoing, and otherwise very distinct. General tone lighter, pattern more blended and diffuse, more as in an *Antrostomus*. ♂, adult: Assuming upper parts gray, this color intimately punctate with lighter and darker shades, more boldly marked with blackish, chiefly in streaks, and with tawny and white, largest on the scapulars and wing-coverts. Under parts barred, as in *popetue*, with blackish, tawny, and whitish, but the two former prevailing. A large white V on the throat. *Four* outer primaries with large white spot on both webs, nearer tip than bend of the wing; inner primaries and all the secondaries spotted with tawny in broken bars. Tail blackish, with broken gray or tawny bars, and a complete subterminal cross-bar of white on all the feathers but the central pair. ♀ lacking this white, all the tail-feathers being motley-barred with gray and tawny throughout; the primaries all spotted with tawny, larger spots of this color replacing the white of the ♂; throat-V tawny. Young more suffused with tawny on a pearly-gray, black-speckled ground; but young ♂ with the white tail- and wing-spots from the first. Length 8.00 or more; extent 20.00–22.00; wing about 7.00; tail 4.00. S.W. U. S., valleys of Rio Grande and Colorado, Texas to California

and southward, common. General habits and traits of a night-hawk, but the difference between the two is obvious when they are flying. Eggs 2, heavily veined and marbled, 1.20× 0.87.

22. Family CYPSELIDÆ: Swifts.

FIG. 296. Northern Black Cloud Swift, nat. size. (E. H. Fitch.)

Fissirostral Picariæ: Bill very small, flattened, triangular when viewed from above, with great gape reaching below the eyes; unnotched, unbristled, the gape about six times as long as the culmen. Nostrils exposed, superior, nearer culmen than commissure, the frontal feathers tending to reach forward under them. Wings extremely long, thin, and pointed (frequently as long as the whole bird); the primaries acute and somewhat falcate: the secondaries extremely short (nine?). Tail of 10 rectrices, variable in shape, often mucronate. Feet small, weak, the envelope rather skinny than scaly; tarsi naked or feathered: hind toe frequently elevated, or versatile, or permanently turned sideways or even forward: lateral toes nearly or quite as long as the middle: anterior toes deeply cleft, the basal phalanges extremely short, the penultimate very long, the number of phalanges frequently abnormal (2, 3, 3, 3, instead of 2, 3, 4, 5; see p. 127, fig. 40); claws sharp, curved, never pectinate. Plumage compact, usually sombre and wholecolored, or only relieved with white; sexes alike. Sternum deep-keeled,

widening behind, its posterior margin entire; furculum stout, rather U- than V-shaped. Oil-gland nude. No cœca. Leg-muscles anomalogonatous (p. 195); femoro-caudal present, but accessory femoro-caudal, semitendinosus, accessory semitendinosus and ambiens absent. Eggs several, narrowly oval, white.

"One of the most remarkable points in the structure of the *Cypselidæ* is the great development of the salivary glands. In all the species of which the nidification is known, the secretion thus produced is used more or less in the construction of the nest. In most cases it forms a glue by which the other materials are joined together, and the whole nest is affixed to a rock, wall, or other object against which it is placed. In some species of *Collocalia*, however, the whole nest is made up of inspissated saliva, and becomes the 'edible bird's nest' so well known in the East." (SCLATER.)

A well-defined family of 6 or 8 genera and about 50 species, inhabiting temperate and warm parts of the globe. They are rather small birds, of plain plumage, closely resembling swallows in superficial respects, but with no real affinity to these *Oscines*. Notwithstanding the utmost difference in the shape of the bill, the real affinities are with the tenuirostral *Trochilidæ* in every structural peculiarity. They are birds of extraordinary volitorial ability, being only surpassed in this respect by the hummers themselves. The family is divisible into two subfamilies, according to the structure of the feet.

Analysis of Subfamilies and Genera.

CYPSELINÆ. Front toes with 3 joints apiece. Hind toe lateral or versatile. Tarsi feathered.
Toes feathered. Tail not spiny . . . . . *Panyptila* 131

CHÆTURINÆ. Front toes with 3, 4, and 5 joints from inner to outer. Hind toe posterior or lateral, but not reversed. Tarsi and toes naked.
Tail emarginate, not mucronate . . . . . *Nephœcetes* 132
Tail rounded, mucronate . . . . . *Chætura* 133

31. Subfamily CYPSELINÆ: Typical Swifts.

Ratio of the phalanges abnormal, the 3d and 4th toes having each 3 joints like the 2d; basal phalanges of all the anterior toes very short (fig. 40). Hind toe reversed (in *Cypselus*, where nearly all the species belong), or lateral (in *Panyptila*). Tarsi feathered (in *Cypselus*); toes also feathered (in *Panyptila*). Contains only these two genera and nearly half the species of the family. Of *Panyptila* there are only three well-determined species, all American; while *Cypselus* has upward of twenty, mostly of the Old World; the three or four American ones being sometimes detached under the name of *Tachornis*.

131. PANY'PTILA. (Gr. *πάνυ, panu*, much, very; *πτίλον, ptilon*, wing: in allusion to the length of wing.) ROCK SWIFTS. Tail about ½ as long as wing, forked, with stiffish and narrowed, but not spiny feathers. Wing pointed by the 2d primary, the 1st decidedly shorter. Tarsi feathered to the toes; these also feathered to some extent. Hind toe elevated, lateral, but not reversible. Front toes with slight basal webs. Eyelids naked. Colors black and white.

403. P. saxa'tilis. (Lat. *saxatilis*, rock-inhabiting; *saxum*, a rock.) WHITE-THROATED ROCK SWIFT. Black or blackish; chin, throat, breast, and middle line of belly, tips of secondaries, edge of outer primary and lateral tail-feathers, and a flank-patch, white. Forehead and line over eye pale; a velvety black space before eye. Bill black; feet drying yellowish. The purity of the color varies with the wear of the feathers, some specimens being dull sooty brownish, others more purely and even glossy blackish. The extent of the white along the belly is very variable. The flank-patches are conspicuous, in life sometimes almost meeting over the rump. Length 6.50–7.00; extent about 14.00: wing the same as total length; tail about 2.66, forked, soft. Southwestern U. S. and southward, breeding in colonies on cliffs; a large and beautiful swift — a high-flier of almost incredible velocity, with a loud shrill twitter, nesting in the most inaccessible places, sometimes by thousands. The eggs do not appear to have been taken yet, but are presumed to be white, as in all the species the eggs of which are known. Found N. to Wyoming, Utah, and Nevada.

32. Subfamily CHÆTURINÆ: Spine-tail Swifts.

FIG. 297. — *Chæturinæ*. Head and mucronate tail-feather of *Chætura pelasgica*, nat. size. (Ad nat. del. E. C.)

Toes with the normal number of phalanges; all but the penultimate ones extremely short. Anterior toes cleft to the base (no webbing). Hind toe not reversed, but sometimes versatile; our species have it obviously elevated. Tarsi never feathered; naked and skinny, even on the tibio-tarsal joint. In the principal genus, *Chætura*, containing about half the species of the subfamily, of various parts of the world, the tail-feathers are stiffened and *mucronate* by the projecting rhachis. The other genera are *Collocalia* and *Dendrochelidon* of the Old World; *Cypseloïdes*, and the scarcely different *Nephœcetes*, of the New.

132. NEPHŒ'CETES. (Gr. *νέφος*, *nephos*, a cloud; *οἰκέτης*, *oiketes*, an inhabitant: well applied to these high-flyers.) CLOUD SWIFTS. Tail forked or emarginate, with obtusely-pointed but non mucronate stiffish feathers. First primary longest. Tarsi naked, skinny. Hind toe elevated, but perfectly posterior. Front toes cleft to the base. Nostrils embedded in feathers. Unicolor.

404. N. ni'ger borea'lis. (Lat. *niger*, black; *borealis*, northern. Our species is a variety of the West Indian *N. niger*. Fig. 296.) NORTHERN BLACK CLOUD SWIFT. ♂ ♀, adult. Entire plumage sooty-black, with slight greenish gloss, little paler below than above, the feathers of head and belly with grayish edges. A velvety black area in front of eye; forehead hoary; eyelids partly naked. Bill black; t probably dusky-purplish in life. Length 6.50–7.00; wing the same; tail 2.75, forked nearly 0.50 in the adult ♂, merely emarginate in the ♀; tarsus 0.50; middle toe and claw about the same. Young: Tail rounded; plumage dull blackish, nearly every feather skirted with white, especially noticeable on belly, rump, and upper tail-coverts and inner wing quills; crissum mostly white; supposed to require several years to perfect the black plumage. Rocky Mts. to the Pacific, U. S. and British Columbia; a great black swift still little known; supposed to nest in cliffs up to 11,000 feet; ranges to about 13,000; crops found filled with *Ephemeridæ*.

133. CHÆTU'RA. (Gr. *χαίτη*, *chaite*, a bristle; *οὐρά*, *oura*, a tail. Fig. 297.) SPINE-TAIL SWIFTS. Tail short, less than half as long as wing, even or a little rounded, mucronate, — the stiff spiny shafts of the feathers protruding like needles beyond the webs. First primary longest. Tarsi naked and skinny. Hind toe elevated, but posterior. Front toes all of about the same length, cleft to the base. Feathers reaching to but not far below the nostrils. Unicolor or bicolor (our species one-colored, sombre). Sexes alike.

405. C. pelas'gica. (Gr. *Πελασγοί*, the *Pelasgoi*, a nomadic tribe; Lat. *pelasgica*, i. e., migratory.) CHIMNEY SWIFT. CHIMNEY "SWALLOW." Sooty-brown, with a faint greenish gloss above; below paler, becoming gray on the throat; wings black; a velvety black space about eyes. Length about 5.00; wing the same; extent about 12.50; tail 2.00 or less, even or a little rounded, spiny. Eastern U. S., migratory, very abundant in summer. Like the swallows, which this bird so curiously resembles, not only in its form, but in its mode of flight, its food, and twittering notes, it has mostly forsaken the ways of its ancestors, who bred in hollow trees, and now places its curious open-work nest, of bits of twig glued together with saliva, inside disused chimneys, in settled parts of the country. In districts still primitive, however, it continues to use hollow trees, to which it resorts by thousands to roost. Not impossibly winters in such retreats in a lethargic state! The twigs for its pretty basket-like nest are snapped off the trees by the birds in full flight. The eggs are 4–5, 0.75 to 0.80 long by 0.53 broad, thus narrowly elliptical, and pure white. So great are the volitorial powers of this bird, that the sexes can come together on the wing.

406. C. vauxi. (To Wm. S. Vaux, of Philadelphia.) VAUX'S SWIFT. Similar: paler, the rump and upper tail-coverts lighter than the rest of the upper parts; the throat whitish. Smaller; length 4.50; wing the same; tail 1.67. Pacific Coast, U. S., and southward. Seems to be different from *pelasgica*, but perhaps the same as a S. Am. species. Nesting and eggs as in the common species.

23. Family TROCHILIDÆ: Humming-birds.

FIG. 298. — Humming-birds. (From Michelet.)

Tenuirostral Picariæ. These beautiful little creatures will be known on sight; and as the limits of this work preclude any adequate presentation of the subject, I prefer merely to touch upon it.

The *Trochilidæ*, in all essential structural characters, are nearest related to the *Cypselidæ*. These two groups have in fact been united by some in a superfamily *Macrochires*, in allusion to the length of the hand and its feathers, and tersely described as *schizognathous Insessores*. The flying-apparatus is as in the swifts: a very deep-keeled sternum, for attachment of powerful pectoral muscles, a very short upperarm, but the distal segments of the fore limb lengthened, bearing a thin-bladed or even falcate wing; primaries 10, the 1st usually longest; secondaries reduced to 6, and very short. Tail of 10 rectrices, but otherwise too variable to be characterized, presenting almost every peculiarity in size and shape as a whole, in size and shape of individual feathers, and often differing in form as well as color in the opposite sexes of the same species. Feet extremely small and weak, unfit for progression, formed exclusively for perching; tarsi naked or feathered. Hind toe incumbent. Claws all large, sharp and curved. The bill exhibits the tenuirostral type in perfection, being long and extremely slender for its length; it is usually straight, subulate or awl-shaped, or with lancet-shaped tip; it is often decurved, sometimes recurved, and again bent almost at an angle; in length it varies from less than the head to more than all the rest of the bird. The cutting edges of the mandibles are inflected; the rictus is devoid of bristles. The nostrils are linear, with a supercumbent scale or operculum, sometimes naked, oftener feathered. In size the Hummers average the least of all birds, the giants among them alone reaching a length of 6 or 7 inches, the pygmies being under 3 inches; the usual stature is 3 or 4 inches. In a few the coloration is plain, or even sombre; most have glittering iridescent tints — "the most gorgeously brilliant metallic hues known among created things." The sexes are usually unlike in color.

The chief anatomical peculiarity is the structure of the tongue, which somewhat resembles that of woodpeckers, in being protrusible or capable of being thrust far out of the beak by a muscular mechanism connected with the long horns of the hyoid or tongue-bone, which curve up around the back of the skull. The tongue is in effect a double-barrelled tube, supposed to be used to suck the sweets of flowers. The character of the sternum and wing-bones has been already mentioned. How perfectly the feet are fitted for grasping and perching may be inferred

from the fact that, as in *Passeres* proper, the flexor longus hallucis is independent of the flexor longus digitorum, — that is, the muscle which bends the hind toe works separately from that which flexes the other toes collectively. The arrangement of the thigh muscles is the same as in *Cypselidæ*. There is one carotid artery, the left; a nude oil-gland; no cœca. The pterylosis is characteristic.

The food of the Hummers was formerly supposed to be the sweets of flowers. It is now known that they are chiefly insectivorous. Their little nests are models of architectural beauty. The eggs are always two in number. The young hatch weak and helpless, requiring to be fed by the parents, the Hummers being thus of altricial nature. The voice is not musical.

The family is one of the most perfectly circumscribed in ornithology, and one of the largest of its grade. So intimately and variously are the genera interrelated that every attempt to divide it into subfamilies has proven unsatisfactory. The humners are peculiar to America. Species occur from Alaska to Patagonia; but we have a mere sprinkling in this country. The centre of abundance is in tropical South America, particularly New Granada. Nearly 500 species are current; the number of positively specific forms may be estimated at about 400 or more. The genera or subgenera vary with authors from 50 to 150. The latest critical authority upon the subject gives 426 species, assigned to 125 genera. (Elliot.)

FIG. 299. — Ruby-throated Humming-birds, ♂, ♀, and nest, nearly nat. size. (Sheppard del. Nichols sc.)

None of the known N. A. Hummers exhibits the extremes of shape of bill or tail which some of the tropical genera illustrate; in only one (*Calothorax lucifer*) is the bill decidedly curved. Only one species is as much as 4 inches long, — the magnificent *Eugenes fulgens*. Some curious shapes of tail, including marked sexual characters in this respect, are exhibited by certain genera.

Only one species, the common Ruby-throat, is known to occur in the East; this was the only one known to Wilson. Audubon gave four species, but one of them erroneously. Since his time, however, new forms of these exquisite creatures have successively been brought to light over our Mexican border. In 1858, Baird gave seven (one of them *Lampornis mango*, erroneously, as Audubon had done). In 1872, in the "Key," I was able to increase the number to ten, but with two wrongly given (the *Lampornis* and *Agyrtria linnæi*). The same ten, with the two errors, were given by Baird and Ridgway in 1874. Within a few years the discoveries have been so many, that, after eliminating the two errors, I am able to describe no fewer than *fifteen* perfectly distinct species of United States Humming-birds; and I have no doubt that several others will in due time be found over our Mexican border.

The discrimination of the females and young is difficult; but with the adult males there should be no trouble. The following table is intended to enable the student to tell the genus and species directly of any U. S. Hummer, if the specimen he has in hand be an adult male.

If a female or young, he must refer to the detailed descriptions. He will be much assisted by the figures of generic details, drawn from nature by Mr. R. Ridgway for Mr. D. G. Elliot's monograph, and kindly loaned to me by Prof. Baird.

Analysis of Genera and Species of N. A. Trochilidæ (adult males).

Frontal feathers not fully covering nasal scale. Tarsi feathered. Tail emarginate. Bill broad, in part flesh-colored.
- Nasal scale entirely naked.
  - White stripe on head. Crown, face, and chin, black. Tail rufous . . . . *Basilinna xantusi* 407
- Nasal scale partly naked.
  - Crown green; throat blue; tail blackish. . . . . *Iache latirostris* 421
  - Throat green; tail rufous; sides rufous . . . . . *Amazilia cerviniventris* 420
  - Throat green; tail rufous; sides green . . . . . *Amazilia fuscocaudata* 419

Frontal feathers covering nasal scale.
- Bill not perfectly straight.
  - Bill curved throughout. Tail forked, with almost filiform lateral feather . . *Calothorax lucifer* 418
  - Bill nearly straight. Length over 4 inches. Throat and breast green . . . . *Eugenes fulgens* 408
- Bill perfectly straight. Length under 4 inches.
  - Crown as well as throat with metallic scales.
    - Scales lilac-crimson. Lateral tail-feather parallel-edged . . . . . *Calypte annæ* 414
    - Scales violet. Lateral tail-feather acutely falcate . . . . . *Calypte costæ* 415
  - Crown simply glossy, like back; throat with metallic scales.
    - Middle tail-feathers unlike back in color.
      - Scales confined to ends of throat-feathers, their bases snow-white . . . *Stellula calliope* 417
    - Middle tail-feathers like back in color; throat-scales forming a continuous surface.
      - Lateral tail-feathers white-tipped; none acuminate. Outer primary abruptly emarginate and acute. . . . . *Atthis heloisæ* 416
      - Lateral tail-feathers not white-tipped; some or all acuminate.
        - Throat-scales coppery-red; back and tail greenish; outer two primaries acute, falcate: all the tail-feathers acuminate, the two outer acicular . . . . . *Selasphorus alleni* 412
        - Throat-scales coppery-red; back and tail mostly chestnut; primaries as in *S. rufus*; next to middle tail-feather abruptly notched . . . . . *Selasphorus rufus* 411
        - Throat-scales lilac-red; back golden-green; 1st primary emarginate, turned outward, next obliquely incised at end . . . . . *Selasphorus platycercus* 413
        - Throat-scales opaque black, becoming violet posteriorly; back golden-green; primaries not peculiar . . . . . *Trochilus alexandri* 410
        - Throat-scales ruby-red; back golden-green. Primaries not peculiar (Eastern) *Trochilus colubris* 409

134. BASILIN'NA. (Gr. βασίλιννα, *basilinna*, a queen.) QUEEN HUMMERS. Head appearing more globose than in any other N. Am. genus, in consequence of the non-extension of the feathers on base of upper mandible, where they do not reach opposite those on chin, leaving the turgid nasal scale entirely exposed. Bill broad at base, tapering regularly to tip, with distinct supra-nasal grooves; scarcely longer than head, straight. Tarsi feathered. Tail ample, all the feathers broad and rounded; nearly even, in ♂ a little double-rounded by shortness of both lateral and central pair of feathers, in ♀ simply a little rounded. No peculiarity of primaries. Sexes nearly alike in form: ♀ lacking the green gorget of ♂; bill in both sexes largely flesh-colored; ♂ with white stripe on head: no white on tail of either sex. (N. B. This genus would be better ranged next after *Iache*.)

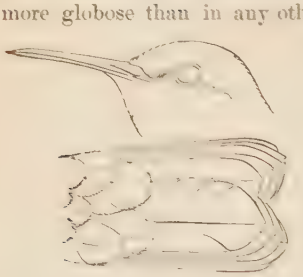


FIG. 300. — Xantus Hummingbird, nat. size. (From Elliot.)

407. B. xan'tusi. (To L. J. Xantus de Vesey. Fig. 300.) XANTUS HUMMING-BIRD. Adult ♂: Above, and the throat, metallic grass-green; below, cinnamon-rufous; face blue-black; a white stripe through the eye; wings purplish-dusky; tail purplish-chestnut, the central feathers glossed with golden-green; bill flesh-colored, black-tipped. ♀: Shining green above, including central tail-feathers; below, and the face, pale rufous, whitening about the vent, and the sides greenish; head-stripe rufous, whitening on the auriculars; tail-feathers, except the central,

chestnut, with a dark terminal spot. Length 3.50; extent 4.75; wing 2.10; tail 1.25; bill 0.72. Cape St. Lucas.

135. **EU'GENES.** (Gr. *εὐγενής, eugenes,* well-born.) FULGENT HUMMERS. Of great size: about 5 inches long. Bill much longer than head, not quite straight, flattened and slightly widened at base, subcylindrical in continuity, with lancet-pointed tip. Frontal feathers extending on nasal scale. Tail ample, in ♂ moderately forked, in ♀ double-rounded, all the feathers broad, with rounded ends. Tarsi feathered. A tuft of downy white at insertion of feet. Outer primary but little narrower or more falcate than the rest. Sexes nearly alike in form, unlike in color. Bill black; no white on tail of ♂.

408. **E. ful'gens.** (Lat. *fulgens,* glittering. Figs. 301, 302.) REFULGENT HUMMING-BIRD. ♂: Tail simply forked. General body-color shining golden-green above and below, duller on belly and crissum, on breast showing opaque black when viewed from before backward. Crown glittering metallic violet in proper light, opaque black viewed obliquely from behind forward. Gorget glittering emerald-green in proper light, opaque greenish-black from the opposite direction. White marks about eyes. Tail like body, but more brassy. Wing-coverts and lining of wings like body; quills dusky-purplish. Large: length about 5.00; extent 6.50; wing 2.75; tail 1.75; bill over an inch from the feathers on culmen, nearly 1.50 along gape. ♀: Upper parts like those of the ♂, but crown like back. No emerald gorget, the whole under parts whitish, specked here and there with green, the throat with dusky specks. Wings as in ♂, but tail very different; double-rounded, both central and lateral feathers shorter than intermediate ones; middle feathers brassy-green, others the same in decreasing extent, increasing in blackish towards ends, and squarely tipped with dull white. Smaller: length about 4.50; wing 2.50; tail 1.50; bill, however, about as long. Our largest and most magnificent species, lately discovered in Arizona. Texas?

FIG. 301. — Refulgent Humming-bird, head, nat. size. (From Elliot.)

FIG. 302. — Tail of the same, ♂, nat. size. (From Elliot.)

136. **TRO'CHILUS.** (Gr. *τρόχιλος, trochilos,* Lat. *trochilus,* a runner: a plover so named by Herodotus: by Linnæus transferred to Humming-birds.) GORGET HUMMERS. Bill slender and subulate, not widened at base; frontal feathers covering nasal scale. Tail in ♂ forked or emarginate, with lanceolate feathers; in ♀ simply rounded or double-rounded, with broader feathers. Outer four primaries not peculiar; but the 1st one strongly curved or bowed at end inwards; inner six abruptly smaller and more linear (in ♂ at least). Tarsi naked. Bill black. A metallic gorget in ♂, not prolonged into a ruff; no scales on crown. ♀ lacking the gorget; and tail white-tipped.

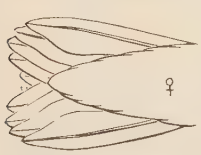


FIG. 303. — Ruby-throated Humming-bird, ♀, tail, nat. size. (From Elliot.)

FIG. 304. — Ruby-throated Humming-bird, ♂, nat. size. (From Elliot.)

409. **T. co'lubris.** (Latinized from the barbarous *colibri.* Figs. 299, 303, 304.) RUBY-THROATED HUMMING-BIRD. ♂: Tail forked, its feathers all narrow and pointed; no scales on crown; metallic gorget reflecting ruby-red. Above, golden-green; below, white, the sides green; wings and tail dusky-purplish. ♀: Lacking the gorget; throat white, specked with

dusky; tail double-rounded, the central feathers shorter than the next, the lateral then graduated: all broader than in ♂ to near the end, then rapidly narrowing with concave inner margin; tail with black bars, and the lateral feathers white-tipped; no rufous on tail in either sex. Length of ♂ 3.25: extent 5.00; wing 1.75; tail 1.25; bill 0.66. ♀ smaller: length 2.80; extent 4.60. Eastern N. Am., especially U. S., abundant in summer, generally seen hovering about flowers, sometimes *in flocks*. Feeds on insects, and the sweets of flowers. Nest a beautiful structure, of downy substances, stuccoed with lichens outside; eggs two, white, 0.50 × 0.35.

410. T. alexan'dri. (To Alexander. Fig. 305.) ALEXANDER HUMMING-BIRD. Size and general appearance of *T. colubris*. ♂: Tail double-rounded, i. e., centrally emarginate, laterally rounded: central emargination about 0.10, lateral graduation more; the feathers all acuminate, and whole-colored. Upper parts, including two middle tail-feathers, as in *T. colubris*. Gorget opaque velvety black, only posteriorly glittering with violet, sapphire and emerald. Other under parts whitish, green on sides. Length 3.25; wing 1.75; tail 1.25; bill from frontal feathers 0.75. ♀: Tail different from that of ♂, both in shape and color; simply slightly rounded (without appreciable central emargination), the lateral feathers scarcely acuminate; middle feathers like the back, darkening at ends; others with broad purplish-black space near end, and white-tipped: thus so closely resembling *colubris* ♀ that the lack of decided emargination of the tail is the principal character. No gorget, the throat whitish with dusky specks. California, Utah, Arizona, and probably other portions of SW. U. S.

FIG. 305. — Alexander Humming-bird, tail of young ♂ and ♀, nat. size. (From Elliot.)

137. SELASPHORUS. (Gr. *σέλας*, light; *φορός*, bearing.) LIGHTNING HUMMERS. Bill slender and subulate: frontal feathers covering nasal scale. Tail in ♂ ♀ graduated or rounded, not forked, and extensively rufous or tipped with white. The central much broader than the lateral feathers. Details of shapes of the feathers varying with the species, and with the sexes (see descriptions, and figs. 306, 307). Outer primary, or two outer ones, of ♂ abruptly attenuate, the end bowed: inner six primaries not abruptly narrower than those further outward. Tarsi naked. Bill black. A metallic gorget in ♂, little or not produced into a ruff; no scales on crown. ♀ lacking the gorget, and tail white-tipped.

411. S. ru'fus. (Lat. *rufus*, reddish.) RED-BACKED RUFOUS HUMMING-BIRD. NOOTKA HUMMING-BIRD. ♂: No metallic scales on crown. Gorget glancing coppery-red, somewhat prolonged into a ruff. Tail cuneate; middle pair of feathers broad, narrowing rather suddenly to a point. Next pair broad, *nicked or emarginate near end* (fig. 306). Next three pairs successively narrowing gradually, but not even the outer becoming acicular. Two outer primaries narrow, falcate, gradually very acute, the ends bowed inward. General color above and below cinnamon-red, becoming more or less green on the crown, and sometimes flaked with green on the back, fading to white on the belly. Tail-feathers cinnamon-red, deepening to dusky-purplish at ends. Quills dusky-purplish. Length about 3.50; wing 1.50–1.67, averaging 1.60; tail 1.30; bill 0.65. ♀ showing the characters of the tail and wing, but less plainly. Coloration extensively rufous, but overlaid with green; no gorget, replaced by a few dusky-greenish feathers; under parts extensively white, but shaded with cinnamon on the sides and crissum. Middle tail-feathers glossed with greenish, darkening to black at end, and usually touched with cinnamon at base; other tail-feathers extensively rufous, then black, finally white-tipped. Length 3.20; wing 1.70; tail 1.20. (On comparing ♀ *rufus* with ♀ *platycercus*, a great difference in the size of the outer feather is observable: in *rufus* this feather is only 0.12 broad, and under 1.00 long; in

FIG. 306. Tail of *S. rufus*, nat. size.

platycercus the same feather is 0.25 wide, and over 1.00 long.) Rocky Mts. to the Pacific, N. to Alaska; the commonest and most extensively distributed species in the West. Noted as the northernmost known species of the family. (This is *S. rufus*, Gm., the true "Nootka Sound Humming-bird," the ♂ easily known by its cinnamon-red back, and the nick in the next to the middle tail-feather. *S. henshawi* Elliot.)

412. S. al'leni. (To C. A. Allen, of California. Figs. 307, 308.) GREEN-BACKED RUFOUS HUMMING-BIRD. ALLEN HUMMING-BIRD. In generalities similar to the last. ♂: Two outer tail-feathers on each side very small and narrow, the outermost almost acicular; next little larger; third abruptly larger; fourth from the outer smaller than third or middle pair. Upper parts golden-green, dullest on crown. Under tail-coverts, belly and sides cinnamon, paler on the median line, white on breast next to the gorget. Tail-feathers cinnamon, tipped and edged with dusky-purplish. Gorget fiery-red. Length about 3.00; wing 1.50; tail 1.18; bill 0.64. ♀ similar to ♀ *rufus;* averaging smaller; tail-feathers narrower, especially the outer ones. Coast region of California and northward. (This is the bird of ten described as ♀ *rufus;* carefully distinguished by Henshaw, Bull. Nutt. Club, ii, 1877, p. 53; considered by Elliot to be true *rufus* Gm.)

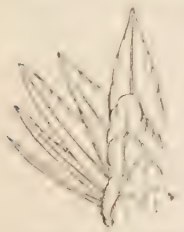


FIG. 307. — Tail of *S. alleni*, nat. size.

FIG. 308. — Green-backed Rufous Humming-bird, ♂, nat. size. (From Elliot.)

413. S. platycer'cus. (*Gr. πλατύς, platus*, broad; *κέρκος, kerkos*, tail. Fig. 309.) BROAD-TAILED HUMMING-BIRD. ♂: No scales on top of head; crown like back. A gorget of scales, not prolonged into a ruff. Outer primary attenuate, acuminate, ending acicular, the point turned outward; next primary also narrowed, not so much so as the first, its end obliquely incised with a slight nick. Tail ample; middle feathers scarcely or not shorter than the next, but the rest rapidly graduated; middle and several lateral ones broad, briefly acuminate, the outermost narrowed linearly with rounded end. Above, including crown, golden-green; the two middle tail-feathers purer shining grass-green; lateral tail-feathers purplish-dusky, some of them with narrow longitudinal chestnut *edging* only on one or the other web (a strong character of the species: compare extensively rufous tail-feathers of the two foregoing species). Gorget glancing lilac-red: other under parts whitish, glossed with golden-green on the sides and sometimes elsewhere. Quills purplish-dusky. Length nearly or quite 4.00; extent 4.75–5.00; wing nearly or quite 2.00; tail 1.35; bill 0.70. ♀: Outer primary narrow and falcate, but without special attenuation at end. Outermost tail-feather narrower than the rest, as in the ♂, but the others rounded at ends, not acuminate. Lateral tail-feathers chestnut at base quite across, then black for a space, then white-tipped. Above, like ♂; below, no gorget, the throat white with dark specks; no green on sides, which are more or less rufous, as in *S. rufus* ♀, from which some care must be taken in discrimination. It is usually less rufous below; middle tail-feathers

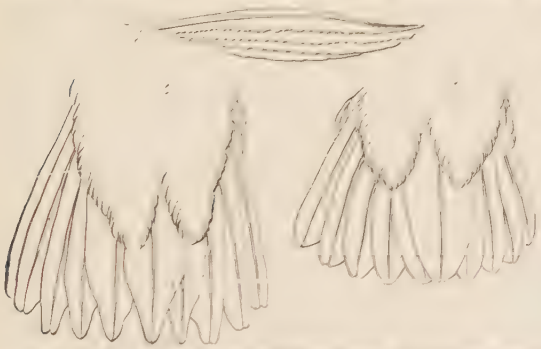


FIG. 309. — Broad-tailed Humming-bird, ♂. ♀. nat. size. (From Elliot.)

entirely green, these having dark ends in *rufus* ♀; rufous on lateral tail-feathers confined to their bases and of less extent than the black, while in *rufus* ♀ the rufous equals or exceeds the black area. The next to the middle tail-feather in *platycercus* ♀ is green, with only rufous edging of outer web near base, short black end, and white tip: in *rufus* ♀ the same feather is rufous on both webs to an extent equal to the green, black, and white spaces all together. Though such details are not absolutely constant, they suffice to distinguish all the many specimens I have examined. (See also *S. rufus* ♀.) Southern Rocky Mt. region, U. S. and southward. N. to Wyoming, Idaho, Utah, Nevada; Sierras Nevadas of California.

138. **CALYPTE.** (Gr. Καλυπτή, *Kalupte*, a proper name.) HELMET HUMMERS. Crown of ♂ with metallic scales like the gorget, which is prolonged into a ruff; outer primary not attenuate; tail of ♂ forked, the outer feather abruptly narrow and linear, of ♀ slightly double-rounded. No peculiarity of primaries. Bill ordinary, as in *Selasphorus* or *Trochilus;* black. No rufous color anywhere. Tail of ♂ unvaried; of ♀ white-tipped. (Our only genus with bill ordinary and scales on *crown* of ♂.)

414. **C. an'næ.** (To the Duchess of Rivoli. Figs. 310, 311.) ANNA HUMMING-BIRD. ♂: Top of head with metallic scales like those of throat, the latter prolonged into a ruff; the iridescence lilac-crimson, covering whole head and throat, except a separating line through eye. Tail deeply forked; middle feathers very broad and rounded, the lateral all successively more narrowed and linear, especially the outermost, but all still with obtuse ends. Outer primary narrower than the next, but of no special peculiarity. Back and middle tail-feathers golden-green; other tail-feathers, like the wing-quills, purplish-dusky, without any rufous or white; under parts whitish, nearly everywhere glossed over with green. Length about 3.50; wing 1.90; tail 1.35; bill 0.75. ♀ like the ♂ excepting on head and tail. No metallic scales on head; crown like back, golden-green; throat whitish with dusky specks. Tail gently rounded, with slightest central emargination, all but the middle feathers (which are like back) green (or gray) at base, then black for a space, then white-tipped (no rufous). Under parts gray, with much green gloss. California, common, resident.

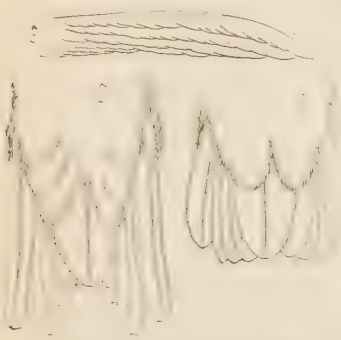


FIG. 310. — Anna Humming-bird, ♂, ♀, nat. size. (From Elliot.)

FIG. 311. — Anna Humming-bird, ♂, nat. size. (From Elliot.)

415. **C. cos'tæ.** (To — Costa. Fig. 312.) COSTA HUMMING-BIRD. ♂: Metallic scales on top and sides of head as well as throat, latter prolonged into a flaring ruff; the iridescence violet, sapphire, steel-blue or purplish, not *red*. Tail lightly forked; middle feathers broad and obtuse, lateral narrowing successively, but the outermost abruptly narrowest, falcate — very noticeable. Outer primary simple. Back and middle tail-feathers golden-green; other tail-feathers like the wing-quills, purplish-dusky. Below whitish, the belly gray, glossed with golden-green. Small: length 3.00–3.25; wing 1.75–1.80; tail 1.00; bill 0.67. ♀: No scales on head. Tail simply rounded, or with least possible central emargination; lateral tail-feathers narrowing, but outermost not noticeably different from the next. Crown like back; throat like belly, with dark specks. Middle tail-feathers like back, others green or gray, then black, then white-tipped. Entire under parts whitish. Compared with *annæ*, the only other with scales on crown in ♂, *costæ* is smaller: throat ruff much more flaring; glitter entirely different (not red at all); tail less forked, with almost acicular

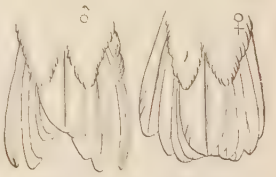


FIG. 312. — Costa Humming-bird, ♂, ♀, nat. size. (Elliot.)

falcate outermost feather instead of straight linear parallel-sided rounded-ended; and under parts less glossed with green. The ♀ *costæ* lacks green gloss on under parts which are more white, has much narrower tail-feathers, and is smaller, in comparison with ♀ *annæ*. The ♀ *costæ* more closely resembles ♀ *Stellula calliope*, but the latter has traces at least of rufous on tail and under parts. Also resembles ♀ *Trochilus*, but has *all* the lateral tail-feathers white-tipped. Arizona and Southern California, and southward.

139. **AT'THIS.** (Gr. 'Ατθίς, *Atthis*, Attic; also a proper name.) ATTIC HUMMERS. Crown of ♂ not metallic like the gorget, which is prolonged into a ruff; outer primary of ♂ attenuate; tail graduated, the feathers rounded at the end, the lateral black-barred and white-tipped in both sexes (peculiar in this respect among N. Am. genera). Bill only about as long as head. Size very diminutive.

416. **A. heloi'sæ.** (Fig. 313.) HELOISE HUMMING-BIRD. ♂: Outer primary attenuate at end, with a needle-like point, as in *S. platycercus*, but not bowed outward. Tail graduated, the central feathers, however, slightly shorter than the next, all round-ended, none notably narrowed. No scales on crown; those of throat produced into a ruff. Bill diminutive. Above, including crown and middle tail-feathers, golden-green, the tail-feathers rather more grass-green, sometimes darkening at end or with a touch of rufous. Other tail-feathers rufous at base, then black-barred, then white-tipped — the only case of such parti-coloration in the *male* in United States species. Gorget glancing violet, sapphire, and lilac. Under parts snowy-white, glossed with golden-green, touched with rufous on flanks. Very small: length 2.75; wing 1.25; tail 0.75; bill 0.50. ♀: No peculiarity of outer primary. Colors much as in the ♂, but no gorget, the throat being white, specked with dusky; the flanks and crissum more rufous. Texas and southward; probably also New Mexico and Arizona.

FIG. 313. — Heloise Humming-bird, ♂ ♀, nat. size.) From Elliot.)

140. **STEL'LULA.** (Lat. *stellula*, dim. of *stella*, a star.) STARRY HUMMERS. No scales on crown; those of throat confined to the tips of the lengthened feathers, thus not forming a continuous metallic surface, but set like stars in a fleecy, snowy bed. Tail of ♂ slightly double-rounded, the lateral feathers graduated, the central also shorter than the next; middle feathers *un*like back in color; all broad, and rather widening to near the suddenly contracted ends; outer feather slightly incurved, the others ending about as acutely as a silver teaspoon. Outer primary simple. Bill longer than head, ordinary, but not entirely black. ♀ like ♂ in form of tail and wings. Size very diminutive.

417. **S. calli'ope.** (Gr. Καλλιόπη, *Kalliope*, Lat. *Calliope*, one of the Muses. Fig. 314.) CALLIOPE HUMMING-BIRD. ♂: Crown and back golden-green. All tail-feathers dusky, with rufous at base and slightly pale tips. Gorget violet or lilac, set in snowy-white; sides of throat, and crissum, white. Below, white, glossed with green on the sides. Bill yellowish below. Length 2.75; wing 1.60; tail 1.00; bill 0.60. ♀: Form of the ♂; color of upper parts the same. No gorget; throat whitish with dark specks; other under parts quite strongly tinged with rufous. A white mark under eye; bill light at base below. Middle tail-feathers green, not so golden as the back, ending

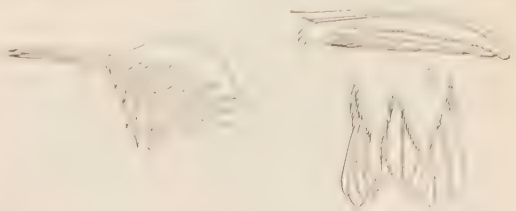


FIG. 314. — Stellula calliope, ♂, nat. size. (From Elliot.)

with dusky; others green (or gray) for a distance decreasing on successive feathers, crossed with black, tipped with white to reciprocally increasing extent, and touched with rufous at base, as in several allied species; but the small size, slight rufous on tail, and the extensive rufous on under parts, are characteristic. Mts. of whole Pacific slope, U. S.; E. to Nevada; S. into Mexico.

141. CALOTHO'RAX. (Gr. καλός, *kalos*, beautiful; θώραξ, *thorax*, chest.) LUCIFER HUMMERS. Very different from any of the foregoing. Bill *curved* throughout, longer than head; but nasal scale covered as usual by feathers, and color of bill black. Tail deeply forked; lateral tail-feather shorter than next, and in our species filiform and acicular. Tarsi partly plumose. Sexes unlike.

418. C. lu'cifer. (Lat. *Lucifer*, the light-bearer; *lux*, light, *fero*, I bear. Fig. 315.) LUCIFER HUMMING-BIRD. ♂: Above, bronzy-green; gorget lilac-purple; wings and tail purplish-dusky. Below, white, bronzed with green on the flanks. Bill black. Length 3.25; wing 1.50; tail 1.35; bill 0.75. ♀: Above, like ♂, but browner on head; no gorget; under parts rufous. Middle tail-feathers bronzy-green, next green tipped with black; the rest rufous basally, then crossed with black and tipped with white. Tail shaped as in the ♂? (My description is unsatisfactory; but the species should be known by the curved bill.) Arizona: introduced into our fauna upon a ♀ wrongly identified as "Doricha enicura." (See Bull. Nutt. Club, ii, 1877, p. 108.)

FIG. 315. — Lucifer Humming-bird, ♂, nat. size. (From Elliot.)

142. AMAZI'LIA. (Latinized from *amazili*, vox barb.) AMAZILI HUMMERS. Belonging to a group which includes *Basilinna* and *Iache;* very unlike any of the others. Nasal scale large and tumid; nasal slit entirely exposed; feathers extending in a point on the sides of the culmen, sweeping obliquely across the basal part of the nasal scale, and forming at the angle of the mouth a deep re-entrance with those of the chin, which reach much farther forward on the interramal space. Bill light-colored, dark-tipped, quite broad and flattened at base, thence gradually tapering to the acuminate tip, slightly bent downward, the curve most noticeable just back of the middle. Tarsi appearing feathered nearly to the toes, but really naked except at the top in front. No lengthened ruffs or tufts about the head; no metallic scales on top of head, different from those of the upper parts at large; no special head-markings. Tail ample, forked or emarginate, the feathers all broad and obtuse, with simply rounded ends. No peculiar primaries, though the outer ones are narrower and more falcate than the next. Of large size, usually 4–5 inches. Sexes alike in form and color. An extensive genus, covering some 25 species, two of which are known to reach our border: above characters more particularly applicable to these.

419. A. fuscocauda'ta. (Lat. *fusco*, with dusky, *caudata*, tailed.) DUSKY-TAILED HUMMING-BIRD. ♂ ♀: Above, metallic grass-green, or golden-green, more brassy on crown and rump, the long upper tail-coverts cinnamon-rufous. Wings purplish-dusky, their coverts like back. Tail deep chestnut, the feathers edged and ended with bronzy-purplish. Throat, breast and sides metallic green, glittering emerald in certain lights on the former, on the latter duller and more bronzy; feathers gray beneath the metallic tips, and this color prevailing on the abdomen; crissum rufous; flank-tufts fleecy white. Bill extensively light-colored, dusky at end. Length about 4.00; wing 2.25; tail 1.60; bill 0.80. Differs from the next in not having the under parts extensively fawn-colored. Lower Rio Grande of Texas, to S. Am.

420. A. cerviniven'tris. (Lat. *cervinus*, like a deer, *cervus;* in this case meaning fawn-colored; *ventris*, of the belly.) RUFOUS-BELLIED HUMMING-BIRD. ♂ ♀: Upper parts shining golden-green, nearly uniform from head to tail, but top of the head rather darker, and with a reddish

gloss in some lights, and upper tail-coverts somewhat shaded with reddish. Metallic gorget of great extent, reaching fairly on the breast, glittering green when viewed with the bill of the bird pointing toward the observer, dusky-green when seen in the opposite direction. Less scintillating and more golden-green feathers extend a little farther on the breast and sides, and most of the under wing-coverts are similar. Belly and under tail-coverts dull rufous or pale cinnamon; flocculent snowy-white patches on the flanks. Wings blackish, with purple and violet lustre. Tail large, forked about one-third of an inch; color intense chestnut, having even a purplish tinge when viewed below, the middle feathers glossed with golden-green, especially noticeable at their ends, and all the rest tipped and edged for some distance from their ends with dusky. Length 4.00 or more; extent 5.50; wing 2.30; tail 1.50; bill 0.90. Lower Rio Grande of Texas to Yucatan.

Fig. 317. — Paradise Trogon, or Quesal (*Pharomacrus mocinno*), ♂, ♀. (From Michelet.)

143 **I'ACHE.** (Gr. Ἰαχή, *Iache*, a proper name. Fig. 316.) Circe Hummers. Near *Amazilia;* with broad and not perfectly straight bill longer than head, reddish at base, and frontal feathers covering the nasal scale; the supranasal groove very distinct. Tail ample, forked, with broad obtuse feathers; no wing- or tail-feathers peculiar in shape. Tarsi feathered. Sexes unlike in color.

421. **I. latiros'tris.** (Lat. *latus*, broad; *rostrum*, beak.) Circe Humming-bird. ♂: Above and below glittering green; more golden above, more emerald below; throat sapphire-blue; tail steel-blue-black, the feathers tipped with gray; flanks and under tail-coverts white. Bill reddish, tipped with black. Length nearly 4.00; wing 2.00–2.25; tail 1.30, forked 0.35; bill 0.80. ♀ above like ♂, but middle tail-feathers bronzy-green; others bronzed at base, then broadly bluish, then white-tipped. Under parts dark gray. Easily recognized among our species by the special coloration, as described, and by the peculiarities of the bill; in all our genera excepting *Iache*, *Amazilia* and *Basilinna*, the nasal scale is fully covered by the extensive frontal feathers. Arizona and Mexico.

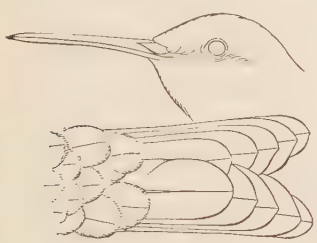


Fig. 316. — Circe Humming-bird, ♂, nat size. (From Elliot.)

4. Suborder CUCULIFORMES: Cuculiform Birds.

The nature of this large group has been indicated on the preceding page (446).

24. Family TROGONIDÆ: Trogons.

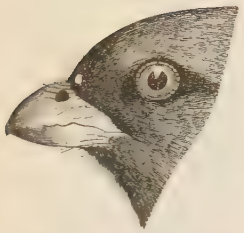


FIG. 318. — Head of Copper-tailed Trogon, nat. size.

Feet zygodactyle by reversion of the second toe (see p. 127). The base of the short, broad, dentate bill is hidden by appressed antrorse feathers; the wings are short and rounded, with falcate quills; the tail is long, of twelve broad feathers; the feet are very small and weak. The general plumage is soft and lax, the skin tender, the eyelids lashed. A well-marked family of about 50 species and perhaps a dozen genera, chiefly inhabiting tropical America. They are of gorgeous colors, and among them are found the most magnificent birds of this continent (fig. 317).

144. **TROGON.** (Gr. τρώγων, *trogon*, a gnawer: alluding to the dentate bill.) The leading genus, to which the above characters fully apply.

422. **T. ambi'guus.** (Lat. *ambiguus*, ambiguous, as doubtfully distinct from *T. mexicanus*. Fig. 318.) COPPER-TAILED TROGON. Metallic golden-green; face and sides of head black; below from the breast carmine; a white collar on the throat; middle tail-feathers coppery-green, the outer white, finely variegated with black; quills edged with white. Length about 11.00; wing 5.25: tail 6.75. Valley of the Lower Rio Grande, and southward.

[Family MOMOTIDÆ: Sawbills.

FIG. 319. — Head of Blue-headed Saw-bill, nat. size.

Feet syndactyle by cohesion of third and fourth toes (p. 129); *tomia serrate.* A very small family of tropical American birds, comprising about 15 species, none having really rightful place here; but the *Momotus cœruleiceps* (fig. 319) comes near our border, and is included to illustrate the suborder. In this species, the central tail-feathers are long-exserted, and spatulate by absence of webs along a part of the shaft — a mutilation effected, it is said, by the birds themselves; the bill is about as long as the head, gently curved; the nostrils are rounded, basal, exposed; the wings are short and rounded; the tarsi are scutellate anteriorly. It is greenish, with blue head. Mexico.]

25. Family ALCEDINIDÆ: Kingfishers.

Feet syndactyle by cohesion of third and fourth toes (p. 129, fig. 44); *tomia simple.* Bill long, large, straight, acute (rarely hooked); somewhat "fissirostral," the gape being deep and wide. Tongue rudimentary or very small. Nostrils basal, reached by the frontal feathers. Feet very small and weak, scarcely or not ambulatorial; tibiæ naked below; tarsi extremely short, reticulate in front; hallux short, flattened underneath, its sole more or less continuous with the sole of the inner toe; soles of outer and middle toe in common for at least half their length; inner toe always short, in one genus rudimentary, in another wanting (an abnormal modification). Developed toes always with the normal ratio of phalanges (2, 3, 4, 5; p. 127); middle claw not serrate. Wings long, of 10 primaries. Tail of 12 rectrices, variable in shape.

"The Kingfishers form a very natural family of the great Picarian order, and are alike remarkable for their brilliant coloration and for the variety of curious and aberrant forms which

are included within their number. . . . Their characteristic habit is to sit motionless watching for their prey, to dart after it and seize it on the wing, and to return to their original position to swallow it.' . . . The *Alcedinidæ* nest in holes and lay white eggs. It is, however, to be remarked that, in accordance with a modification of the habits of the various genera, a corresponding modification has taken place in the mode of nidification, the piscivorous section of the family nesting for the most part in holes in the banks of streams, while the insectivorous section of the family generally nest in the holes of trees, not necessarily in the vicinity of water." (SHARPE.)

FIG. 320. — A typical Kingfisher, the European *Alcedo ispida*. (From Dixon.)

The nearest allies of the Kingfishers are the Hornbills (*Bucerotidæ*) and Hoopoes (*Upupidæ*) of the Old World, and the Toucans (*Rhamphastidæ*) and Barbets (*Capitonidæ*) of the New. All these families, like the Woodpeckers (*Picidæ*), agree in being anomalogonatous, with two carotids, a tufted oil-gland, and no cœca. The formula of the leg-muscles is the same as in *Trogonidæ*, the accessory femoro-caudal, accessory semitendinosus and ambiens all being absent. (GARROD.) One would gain an imperfect or erroneous idea of the family to judge of it by the American fragment, of one genus and 6 or 8 species. According to the author of the splendid monograph above cited, there are in all 125 species, belonging to 19 genera; the latter appear to be very judiciously handled, but a moderate reduction of the former will be required. They are very unequally distributed. *Ceryle* alone is nearly cosmopolitan, absent only from the Australian region; the Northern portion of the Old World has only 2 peculiar species; 3 genera and 24 species are characteristic of the Ethiopian region; one genus and 25 species are confined to the Indian; while no less than 10 genera and 59 species are peculiar to the Australian. Mr. Sharpe recognizes two subfamilies; in the insectivorous *Daceloninæ* (with 14 genera and 84 species), the bill is more or less depressed, with smooth, rounded, or sulcate culmen. In the

35. Subfamily ALCEDININÆ, Piscivorous Kingfishers,

the bill is compressed with carinate culmen. The American species all belong here. It is the more particularly piscivorous section: the *Daceloninæ* feed for the most part upon insects, reptiles and land mollusks. *Ceryle* is the only American genus, with 2 North American species. They are thoroughly aquatic and piscivorous, seeking their prey by plunging into the water from on wing: and nest in holes in banks, laying numerous white eggs.

145. **CE'RYLE.** (Gr. κήρυλος, *kerulos*, a kingfisher.) BELTED KINGFISHERS. Head with an occipital crest. Bill longer than head, straight, stout, acute. Wings long and pointed. Tail rather long and broad (in comparison with some genera), much shorter than wing. Tarsi short; legs naked above the tibio-tarsal joint. Plumage belted below.

Large species, dull blue above . . . . . *alcyon* 423
Small species, glossy green above . . . . . *cabanisi* 424

423. C. al/cyon. (Lat. *alcyon*, a kingfisher. Fig. 321.) Belted Kingfisher. Upper parts, broad pectoral bar, and sides under the wings, dull blue with fine black shaft lines. Lower eyelid, spot before eye, a cervical collar and under parts except as said, pure white; the ♀ with a chestnut belly-band and the sides of the same color. Quills and tail-feathers black, speckled, blotched or barred on the inner webs with white; outer webs of the secondaries and tail-feathers like the back; wing-coverts frequently sprinkled with white. Bill black, pale at base below. Feet dark; tibiæ naked below. A long, thin, pointed occipital crest; plumage compact and oily to resist water, into which the birds constantly plunge after their finny prey. Length 12.00–13.00; extent 21.00–23.00; wing 6.00–6.50; tail 3.50–5.00; whole foot 1.33; culmen 1.75–2.25. N. Am., common everywhere, resident or only forced southward by freezing of the waters. This fine bird, whose loud rattling notes are as familiar sounds along our streams as the noise of the mill-dam or the machinery, burrows to the depth of six or eight feet in the ground, and lays as many crystal white spheroidal eggs, 1.25 × 1.05, at the enlarged extremity of the tunnel.

Fig. 321. — Belted Kingfisher, reduced. (From Tenney, after Wilson.)

424. C. america/na caba/nisi. (To Dr. Jean Cabanis, of Germany.) Texan Green Kingfisher. Adult ♂: Entire upper parts glossy-green, with bronze lustre, the bases of nearly all the feathers snowy-white, which appears sometimes upon the surface; crown, scapulars and wing-coverts superficially sprinkled with white. Wing-quills dusky on inner webs, green on the outer, both marked in regular double series with pairs of white spots, scallops or bars. Central tail-feathers dark green, usually touched with white along the edges, the others green with white bars becoming confluent at the bases of the feathers, where forming white spaces more extensive than the green portion. Cervical collar and entire under parts white, the breast, belly, sides and crissum spotted with glossy-green. Bill black, usually light at base below; feet dark. A supposed ♀ differs in having the green-spotted plumage of the under parts and adjoining white area tinged with chestnut. Length about 8.00; wing 3.25–3.50; tail 2.50; bill 1.67; whole foot 1.00. Valleys of the Lower Rio Grande and Colorado, and southward; common. Nesting and eggs as in *C. alcyon;* eggs 4–6, very thin and smooth, like porcelain, rounded oval, 0.90–1.00 × 0.68–0.75.

26. Family CUCULIDÆ: Cuckoos.

Feet zygodactyle by reversion of the fourth toe. This character, in connection with those given below, will answer present purposes; and, in my ignorance of some of the exotic forms, I cannot attempt to give a full diagnosis. The only other North American birds with the toes yoked in the same combination are the *Picidæ* and the *Psittaci*, whose numerous specialties will prevent any misconception regarding *Cuculidæ*. The latter are desmognathous in palatal structure, and homalogonatous, having the ambiens and three or all four of the other leg-muscles used by Garrod for classificatory purposes; in these important respects differing from all birds previously treated in this work. There are two carotids. The oil-gland is nude, and cœca are present. The family is a large and important one. It comprehends quite a number of leading

forms showing peculiar minor modifications; these correspond in great measure with certain geographical areas of faunal distribution, and are generally held to constitute subfamilies. Three or four such are confined to America; about twice as many belong exclusively to the Old World; among them are the *Cuculinæ*, or typical cuckoos allied to the European *C. canorus* (fig. 322), famous, like our Cowbird, for their parasitism. This section comprehends the great majority of the Old World species; the *Couinæ* are a peculiar Madagascan type; others rest upon a special condition of the claws or plumage. There are about 200 current species of the family. Many of them, besides the one just cited in instance, lay their eggs in other birds' nests. The American cuckoos have been declared free of suspicion of such domestic irregularities; but, though pretty well-behaved, their record is not quite clean: they do sometimes slip into the wrong nest. The curious infelicity seems to be connected in some way with the inability of the ♀ to complete her clutch of eggs with the rapidity and regularity usual among birds, and so incubate them in one batch. The nests of our species of *Coccygus* commonly contain young by the time the last egg of the lot is laid.

FIG. 322. — European Cuckoo, *Cuculus canorus*. (From Dixon.)

We have three very distinct genera, usually referred to as many subfamilies.

Analysis of Subfamilies and Genera.

CROTOPHAGINÆ. *Terrestrial.* Tail of 8 feathers. Bill compressed, crested. Plumage lustrous black . . . . . *Crotophaga* 146

SAUROTHERINÆ. *Terrestrial.* Tail of 10 feathers. Feet ambulatorial, with long tarsi. . . . *Geococcyx* 147

COCCYGINÆ. *Arboreal.* Tail of 10 feathers. Feet insessorial, with short tarsi . . . . . *Coccygus* 148

36. Subfamily CROTOPHAGINÆ: Anis.

Tail of *eight* feathers, graduated, longer than the rounded wings. Bill exceedingly compressed, the upper mandible rising into a thin vertical crest, the sides usually sulcate, the tip deflected. Plumage uniform (black), lustrous, the feathers of the head and neck lengthened, lanceolate, distinct, with scale-like margins; face naked. Terrestrial. Nest in bushes. One genus, of three species, of the warmer parts of America.

146. **CROTOPHAGA**. (Gr. κροτών, *kroton*, a bug; φάγος, *phagos*, eating.) ANIS. In addition to the characters of the subfamily: Bill about as long as head, with regularly convex or angulated culmen, its sides smooth, wrinkled, or sulcate; tip of upper mandible decurved over end of lower; gonys straight. Wings rounded; 4th or 5th primary longest, 1st quite short. Tail-feathers broad, widening to very obtuse ends. Tarsus longer than middle toe, anteriorly broadly scutellate, the sides with large plates meeting in a ridge behind. According to the concurrent testimony of various independent observers, the cuculine irregularity of nesting is expressed in a very curious manner, in the case of *C. ani* at least; several birds forming a

sort of colony of Communists uniting to build a large nest to be used in common. The eggs are greenish, overlaid with a white chalky substance, easily rubbed off when fresh.

425. **C. a'ni.** (The Brazilian name. Fig. 323.) ANI. BLACK WITCH. SAVANNA BLACKBIRD. Bill smooth or with a few transverse wrinkles; culmen regularly curved. Color black, with violet and steel-blue reflections, duller below, the lanceolate feathers of the head and neck with bronze borders. Iris brown. Length 13.00–15.00; wing 6.00; tail 8.00; tarsus 1.50. Tropical America; West Indies; Florida; accidental near Philadelphia.

FIG. 323. — Ani, ½ nat. size. (From Brehm.)

426 **C. sulciros'tris.** (Lat. *sulcus*, a groove; *rostris*, pertaining to the beak) GROOVE-BILLED ANI. Bill with three distinct grooves on upper mandible, parallel with the regularly curved culmen. Black, with steel-blue and violet reflections, more olive-brown on belly; scaly feathers of head and neck bronzy, of breast, back and wings metallic greenish. Wings with 4th and 5th quills longest, 3d little shorter, 2d nearly an inch, 1st nearly 2 inches from point of wing. Bill more than twice as high as broad at the base; 0.85 high, 0.37 broad, 1.20 long. Bill and feet black, scaling grayish in some places. Iris brown. Length 14.50; extent 17.00; wing 5.50–6.00; tail 7.50–8.00, graduated 2 inches; tarsus, or middle toe and claw, 1.50. Tropical America; N. to Texas in the lower Rio Grande Valley. Eggs said to be usually five, and no peculiarity of nesting noted; nest of twigs, lined with fibrous roots, in a tree or bush.

FIG. 324. — Head of Geococcyx. (After Cassin.)

37. Subfamily SAUROTHERINÆ: Ground Cuckoos.

Tail of *ten* feathers, graduated, longer than the short, rounded, concave wings. Bill about as long as the head, compressed, straight at base, tapering, with deflected tip, gently curved culmen and ample rictus. Feet large and strong, in adaptation to terrestrial life; tarsus longer than the toes, scutellate before and behind. One West Indian genus, *Saurothera*, with three or four species, and the following, with two: —

147. **GEOCOCCYX.** (Gr. γῆ, *ge*, the ground; κόκκυξ, *kokkux*, a cuckoo.) GROUND CUCKOOS.

FIG. 325. — Ground Cuckoo, ¼ nat. size. (From Brehm.)

Head crested; most feathers of head and neck bristle-tipped; eyelids lashed; whole plumage coarse. A bare colored space around eye. Bill about as long as head, nearly straight, but with culmen and commissure much decurved toward end, gonys if anything a little concave. Wings very short and concavo-convex, with long inner secondaries folding entirely over the primaries; 4th, 5th, and succeeding primaries longer than 3d, 2d, and 1st, which rapidly shorten. Tail of long tapering feathers, much graduated, making more than half the total length of the bird. Feet as above. Plumage lustrous and variegated above. Sexes substantially alike. Eminently terrestrial; nest in bushes; eggs numerous.

427. G. california/nus. (Of California. Figs. 324, 325.) GROUND CUCKOO. CHAPARRAL COCK. ROAD RUNNER. SNAKE KILLER. PAISANO. Most of the feathers of the head and neck bristle-tipped; a naked area around eye; crown crested; plumage coarse. ♂♀: Above, lustrous bronzy or coppery-green, changing to dark steel-blue on the head and neck, to purplish-violet on the middle tail-feathers; everywhere except on rump conspicuously streaked with white, mixed with tawny on the head, neck, and wings — this white and buff streaking consisting of the edges of the feathers, which are frayed out, fringe-like, producing a peculiar effect. Breast, throat and sides of neck mixed tawny-white and black; other under parts dull soiled whitish. Primaries white, tipped and with oblique white space on outer webs. Lateral tail-feathers steel-blue with green and violet reflections, their outer webs fringed part way with white, their tips broadly white. Lower back and rump, where covered by the folded wings, dark-colored and unmarked; under surface of wings sooty-brown. Bare space around eye bluish and orange. Bill dark horn-color; feet the same, the larger scales yellowish. Young birds are very similar, the iridescence developing with the first growth of the feathers, as in a magpie; more white and less tawny in the streaking. Nearly two feet long; tail a foot or less; wing 6–7 inches; tarsus 2.00; bill 1.66–2.00. Texas, New Mexico, Arizona, California and southward; Colorado; Arkansas River. A bird of remarkable aspect, noted for its swiftness of foot; aided by its wings held as outriggers, it taxes the horse in a race; feeds on fruits, reptiles, insects, and land mollusks. Nest in bushes; a slight, loose structure of twigs, as if the birds were just learning how to build. Eggs 6–8–9, white, elliptical, averaging 1.55 × 1.20. They are laid at considerable intervals, and incubation begins as soon as a few are deposited. The development of the chicks is rapid; perfectly fresh eggs and newly hatched young may be found together; and by the time the last young are breaking the shell the others may be graded up to half the size of the adult. The birds are sometimes domesticated, making amusing pets. They are singular birds — cuckoos compounded of a chicken and a magpie!

38. Subfamily COCCYGINÆ: American Cuckoos.

FIG. 326. — American Tree Cuckoo (*Coccygus americanus*), reduced. (From Tenney, after Wilson.)

Tail of *ten* soft feathers, much graduated, little longer than the wings, which are somewhat pointed, although the first and second quills are shortened. Bill about equalling or rather shorter than the head, stout at base, then much compressed, curved throughout, tapering to a rather acute tip; nostrils basal, inferior, exposed, elliptical; feet comparatively small, the tarsus naked, not longer than the toes. There are four or five genera, and perhaps twenty species, of this subfamily; one genus only is North American, with three distinct species.

121. COC'CYGUS. (An adjectival form derived from κόκκυξ, a cuckoo.) TREE CUCKOOS. Head not crested; all the feathers soft. Bill as above. Wings pointed, but not longer than the tail; inner quills not folding over much of the primaries; 3d and 4th primaries longest, 2d and 5th shorter, 1st much shorter still. Tail of soft rather tapering feathers, with very obtuse ends; much graduated. Tibial feathers flowing; tarsi naked, shorter than middle toe. Our species are strictly arboricole birds of lithe form, blended plumage and subdued colors; the head is not crested; the tibial feathers are full, as in a hawk; the sexes are alike, and the young scarcely different; the upper parts are uniform satiny olive-gray, or "quaker-color," with bronzy reflections. Lay numerous plain greenish elliptical eggs, in a rude nest of twigs

saddled on a branch or in a fork. Though not habitually parasitic, they often slip an egg in other birds' nests, or in each other's. Oviposition is tardy or irregular; the nests usually contain eggs in different stages of development, or eggs and young together. They are well-known inhabitants of our streets and parks as well as of woodland, noted for their loud, jerky cries, which they are supposed to utter most frequently in falling weather, whence their popular name, "rain-crow." Migratory, insectivorous, and frugivorous.

Analysis of Species.

Bill black and bluish.
White below. Wings with little or no cinnamon. Tail-feathers not broadly white-ended.
erythrophthalmus 428

Bill black and yellow. Tail-feathers broadly white-ended.
White below. Wings extensively cinnamon . . . . . *americanus* 429
Tawny below. Ears dusky . . . . . *seniculus* 430

FIG. 327. — Yellow-billed Cuckoo, ½ nat. size. (From Brehm.)

428. C. erythrophthal'mus. (Gr. *ἐρυθρός*, *eruthros*, reddish: *ὀφθαλμός*, *ophthalmos*, eye.) BLACK-BILLED CUCKOO. ♂ ♀: Bill blackish except occasionally a trace of yellowish, usually bluish at base below. Above, satiny olive-gray. Below, pure white, sometimes with a faint tawny tinge on the fore-parts. Wings with little or no rufous. Lateral tail-feathers not contrasting with the central, their tips for a short distance blackish, then obscurely white; no bold contrast of black with large white spaces. Bare circumocular space livid; edges of eyelids red. Length 11.00–12.00; extent about 15.50; wing 5.00–5.50; tail 6.00–6.50; bill under an inch. Very

young birds have the feathers of the upper parts skirted with whitish; the bill and feet pale bluish. Eastern U. S. and Canada, west to the Rocky Mts., N. to Labrador, common; rather more northerly than *C. americanus*, being the commoner species in New England; said to winter in Florida. Nest preferably in bushes, often quite near the ground; eggs 1.10 × 0.80, greenish, deeper-colored, less elliptical and smaller than those of the yellow-billed cuckoo, though probably not to be distinguished with certainty.

429. C. americanus. (Lat. American. Figs. 326, 327.) YELLOW-BILLED CUCKOO. Bill black, extensively yellow below and on the sides of upper mandible. Feet dark plumbeous. Above, satiny olive-gray. Below, pure white. Wings extensively cinnamon-rufous on inner webs of the quills. Central tail-feathers like the back; the rest black with large white tips, the outermost usually also edged with white. Very constant in color, the chief variation being in extent and intensity of the cinnamon on the wings, which sometimes shows through when the wings are closed, and even tinges the coverts. Young differ chiefly in having the white ends of the tail-feathers less trenchant and extensive, the black not so pure; this state approaches the condition of *C. erythrophthalmus*, but does not match it. Length 11.00–12.00; extent 15.50–16.50; wing 5.50–6.00; tail about 6.00; bill a short inch; tarsus 1.00; middle toe and claw rather more. U. S., rather more southerly than the last species, and chiefly Eastern; but also, Pacific coast and Southern Rocky Mts. Nest a slight structure of twigs, leaves and catkins, on a bough or in fork of a tree rather than in a bush; eggs 4 to 8, pale greenish, 1.25 × 0.90, laid irregularly, mostly in June.

430. C. seniculus. (Lat. *seniculus*, a little old man; diminutive of *senex*, probably alluding to the gray on the head.) MANGROVE CUCKOO. Bill much as in the last. Above, the same quaker-color, but more decidedly ashy-gray toward and on head. Below, pale orange-brown. Wings suffused with the color of the belly. Auriculars dark, in contrast. Tail as in the last, but outer feather not white-edged. Size of the others, or rather less. West Indies; Florida, rarely. Eggs as in *C. americanus*.

5. SUBORDER PICIFORMES: PICIFORM BIRDS.

See p. 446 for characters of this suborder. It is a perfectly homogeneous group, so much so as to be often reduced to the grade of a single family, *Picidæ*, then with *Iynginæ* and *Picumninæ* as subfamilies. In palatal characters the Piciform birds exhibit "a simplification and degradation of the ægithognathous structure" (*Huxley*), and this passerine affinity is borne out by the common reduction of the first primary to small size or even spurious condition, leaving but 9 functionally developed primaries; but the details of the construction of the bony palate, as worked out by Parker, are so extraordinary that he has proposed to make the *Piciformes* one of the major divisions of Carinate birds (see p. 173, fig. 80). The greater secondary coverts are likewise as short as in *Passeres*. The feet are highly scansorial by reversion of the fourth toe. In typical *Pici* the bill is straight, hard, often strengthened by lateral ridges, and forming an efficient chiselling instrument. The salivary glands are highly developed, and the hyoidean apparatus is peculiar. The sternum is doubly-notched. Only the left carotid is present; the oil-gland is tufted, and there are no cœca. The accessory femoro-caudal, accessory semitendinosus and ambiens muscle are absent. The nearest relatives of the Piciform birds are the *Capitonidæ* or Scansorial Barbets, and the Toucans (*Rhamphastidæ*); both of which are so closely affined that they might come under the above head, with little modification of the characters here assigned. Of the three families here meant to be included by the term *Piciformes*, the Old World *Iyngidæ* or Wrynecks are most unlike Woodpeckers, having a soft tail and various other peculiarities. The *Picumnidæ* are more Woodpecker-like, but still the tail is soft; in general superficialities they resemble Nuthatches quite curiously. Exclusion of these two families leaves us the

27. Family PICIDÆ: Woodpeckers.

FIG. 328. — European Spotted Woodpecker (*Picus major*), reduced. (From Dixon.)

Feet perfectly zygodactyle by reversion of the fourth toe (in two genera the first toe wanting); *tail-feathers rigid, acuminate; bill a chisel.* This expression will serve for the recognition of any woodpecker (compare diagnoses of previous Picarian families). Wing of 10 primaries, the 1st quite short or even spurious, the wing-formula being quite as in most passerine birds — a crow or thrush, for example. Greater row of secondary coverts short, as in passerine birds at large. Tail of 12 rectrices, but the outermost pair rudimentary, lying concealed at the base of the tail between the penultimate (now exterior) and next pair, so that there appear to be but 10, as usual in Picarian birds (a strong peculiarity). Tail-feathers very stiff and strong, with enlarged elastic shafts, and acuminate at the end. Tarsi scutellate in front, on the sides and behind variously reticulate. Toes strongly scutellate on top. The usual ratio of the toes is: 1st (inner posterior) shortest; 2d (inner anterior) next longer; 3d (outer anterior) longer; 4th (outer posterior) longest of all (in most typical species; in some, however, scarcely or not equalling the 3d in length). The basal joints of the toes are abbreviated. There is a very unusual arrangement of the flexor tendons of the toes (shared, however, among Toucans, Scansorial Barbets, and Jacamars).

These birds have been specially studied, with more or less gratifying success, by Malherbe, Sundevall and Cassin. There are nearly 250 well determined species, of all parts of the world except Madagascar, Australia, and Polynesia. Their separation into minor groups has not been agreed upon; our species are commonly thrown into three divisions, which, however, I shall not present, as consideration of exotic forms shows how the genera are interrelated, and how nice is the gradation in form between the Ivory-bill and the Flicker, which stand nearly at extremes of the family; the little diversity of which is thereby evident. One of our genera, without very obvious external peculiarities, stands apart from the rest in the character of the tongue. In ordinary *Pici* the "horns" of the tongue are extraordinarily produced backward, as slender jointed bony rods curling up over the skull behind, between the skin and the bone, to the eyes or even further; these rods are enwrapped in highly developed, specialized muscles, by means of which the birds thrust out the tongue sometimes several inches beyond the bill (figs. 73, 74). This is not the case in *Sphyropicus*, where the hyoid cornua do not extend beyond the base of the skull, and the tongue, consequently, is but little more extensible than in ordinary birds. The tongue of *Sphyropicus* is beset at the end by numerous brushy filaments, instead of the few acute barbs commonly observed in the family. The same or a similar condition of the parts is observed in *Xenopicus*. In most of our species the bill is perfectly straight, wide and stout at the base, tapering regularly to a compressed and vertically truncate tip, chisel-like, and strengthened by sharp ridges on the side of the upper mandible — an admirable tool for cutting into trees; and in all such, the nostrils are hidden by dense tufts of antrorse feathers. In others, like the Flicker, the bill is smooth and barely curved; the tip is acute and the nostrils are exposed. There is a regular gradation in form between those with the most and the least chisel-like bills. The former are more stocky-bodied birds, with larger heads in comparison with the constricted neck, as any one may satisfy himself by skinning a Pileated or Hairy Woodpecker, and trying to pull the skin over the head — an operation which may be performed on a Flicker. The ridges of the bill, the bevelling of the end, the nasal tufts, and usually the

length of the outer hind toe, are characters which diminish or are lost together as we pass from the Ivory-bill extreme to the Flicker end of the series. The claws are always large, strong, sharp, and much curved: the feet do not present striking generic modifications, except in the three-toed genus *Picoïdes:* the length of the outer hind toe is the most variable factor. The wings are specially noteworthy, for the shortness of the coverts, in exception to the Picarian

FIG. 329. — Ivory-billed Woodpecker, $\frac{1}{3}$ nat. size. (From Brehm.)

rule; and the shortness of the first primary, which may fairly be called spurious; but these points and the remarkable character of the tail have been already mentioned. This member offers indispensable assistance in climbing, when the stiff strong quills are pressed against the tree, and form a secure support. To this end, the muscles are highly developed, and the last bone (*vomer* or *pygostyle*) is large and peculiar in shape. Woodpeckers rarely if ever climb head downward, like Nuthatches, nor are the tarsi applied to their support.

Species are abundant in all the wooded portion of this country, and wherever found are nearly resident. For, although insectivorous, they feed principally upon dormant or at least stationary insects, and therefore need not migrate; they are, moreover, hardy birds. They dig insects and their larvæ out of trees, and are eminently beneficial to the agriculturist and fruit-grower. Contrary to a prevalent impression, their boring does not seem to injure fruit-trees, which may be riddled with holes without harmful result. The number of noxious insects these birds destroy is simply incalculable; what little fruit some of them steal is not to be mentioned in the same connection, and they deserve the good-will of all. The birds of the genus *Sphyropicus* are probably an exception to most of these statements. But Woodpeckers also feed largely upon nuts, berries, and other fruits; and those which thus vary their fare to the greatest extent are apt to be more or less migratory, like the common Red-head for example. Woodpeckers nest in holes in trees, which they excavate for themselves, sometimes to a great depth, and lay numerous rounded pure white eggs, of which the shell has a smooth crystalline texture like porcelain, on the chips and dust at the bottom of the hole. The voice is loud and harsh, susceptible of little modulation. The plumage as a rule presents bright colors in large areas or in striking contrasts, and is sometimes highly lustrous. The sexes are ordinarily distinguishable by color-markings; the young either show sexual characters from the nest, or have special markings of their own.

Artificial Analysis of N. A. Genera of Picidæ.

Toes 3 . . . . . *Picoïdes* 153
Toes 4.
  Tongue not decidedly extensible.
    Body entirely black; head white . . . . . *Xenopicus* 152
    Body variegated; head not white . . . . . *Sphyropicus* 154
  Tongue very extensible.
    Conspicuously crested; much over a foot long.
      Bill white; outer hind toe longer than outer front toe . . . . . *Campephilus* 149
      Bill dark; outer hind toe not longer than outer front toe . . . . . *Hylotomus* 150
    Not crested; a foot long or less.
      Sides of upper mandible distinctly ridged; wings spotted . . . . . *Picus* 151
      Sides of upper mandible indistinctly or not ridged.
        Back lustrous green; belly carmine . . . . . *Asyndesmus* 157
        Back blue-black; belly white . . . . . *Melanerpes* 156
        Back black-barred; belly black-spotted . . . . . *Colaptes* 158
        Back black-barred; belly not spotted . . . . . *Centurus* 155

149. CAMPE'PHILUS. (Gr. *κάμπη, kampe*, a caterpillar; *φίλος, philos*, loving.) IVORY-BILLS. Of largest size, with very strict neck, conspicuously crested head and white bill; color black, with white on wings and neck, and scarlet crest. Bill longer than head, perfectly straight, with truncate tip, bevelled sides, with strong ridges; broader than high at the base. Gonys very long; more than half the commissure. Nostrils concealed by large nasal tufts; antrorse feathers also at base of lower mandible. Outer hind toe much the longest. Wings pointed; 4th, 3d and 5th quills longest; 2d much shorter; 1st very short and narrow. Tail very cuneate. Containing the largest and most magnificent known Woodpeckers, of several species, peculiar to America.

431. C. principa'lis. (Lat. *principalis*, principal; *princeps*, chief. Fig. 329.) IVORY-BILLED WOODPECKER. ♂ ♀: Glossy blue-black; a stripe down side of neck, one at base of bill, the scapulars, under wing-coverts, ends of secondaries and of inner primaries, the bill, and nasal feathers white; feet grayish-blue; iris yellow. A long pointed crest, in the ♂ scarlet faced with black, in the ♀ black. Length 19.00–21.00; extent 30.00–33.00; wing 9.75–10.75; tail 7.00–8.00; bill 2.50; tarsus 2.00. Varies much in size; ♀ smaller than the ♂. A large powerful bird of the S. Atlantic and Gulf States, N. to No. Carolina along the coast, to the Ohio River in the interior; common in the dark heavily wooded swamps, but very wild and wary, and difficult to secure. Nests high in the most inaccessible trees; eggs about 6, 1.35 × 1.00.

150. **HYLOTOMUS.** (Gr. ὑλοτόμος, *hulotomos*, a wood-cutter.) PILEATED WOODPECKERS. General form as in *Campephilus*. Bill as in that genus, but not white, with shorter gonys only about half as long as commissure; nasal plumes as before, but no antrorse feathers on sides of lower mandible. Wings and tail substantially as in *Campephilus*. Feet peculiar: outer posterior shorter than outer anterior toe, and tarsus shorter than inner anterior toe and claw; inner posterior toe very short (fig. 330). Bill dark; general color black, relieved by white, the ♂ with a pointed scarlet crest: ♀ crested, but with black only. Our single species is the representative of the famous black woodpecker of Europe, *Picus martius;* a classic bird, by some considered the type of the Linnæan genus *Picus*. There are several typical American species.

432. **H. pilea'tus.** (Lat. *pileatus*, capped, i. e., crested; *pileum*, a cap.) PILEATED WOODPECKER. General color dull black; throat, post-ocular line, a long stripe from nostrils along side of head and neck, spreading on side of breast, lining of wing, and a great white space at the bases of the wing-quills, white, more or less tinged with sulphury-yellow. Feathers of flanks and belly often skirted, and some of the quills often tipped with the same. ♂: Top of head, including the whole crest, and a cheek-patch, scarlet. ♀: Posterior part of crest only scarlet, and no cheek-patch. ♂ ♀: Bill dark horn-color, paler below; feet blackish-plumbeous; iris yellow. Quite constant in coloration; very variable in size. Length 15.00–19.00 inches, usually 17.00–18.00; extent 25.00–30.00, usually 26.00–28.00; wing 8.00–10.00, usually 8.50–9.00; tail 6.00–7.00; bill 1.50–2.00! ♀ averaging about 2 inches less in length than ♂, and other dimensions proportionally smaller. Northern individuals averaging much larger than southern ones. North Am. at large, common, resident anywhere in heavy timber; but this is a very wild, wary, and solitary bird, — one which grows scarce or disappears among the first with the clearing away of forests in advance of civilization. Nests in remote and secluded woods and swamps, usually at a great height; the taking of eggs is something of an exploit. The eggs measure about 1.25 × 1.00. Eggs of woodpeckers are proportioned rather to the bird's bulk of body than its linear dimensions; those of *Campephilus* and *Hylotomus* are relatively smaller than a flicker's, for instance.

FIG. 330. — Right foot of Pileated Woodpecker, nat. size. (Ad. nat. del. E. C.)

151. **PI'CUS.** (Lat. *picus*, a woodpecker.) BLACK-AND-WHITE SPOTTED WOODPECKERS. Bill more or less nearly equal to head in length, stout, straight, truncate at tip, bevelled toward end, with sharp culmen and distinct lateral ridges on upper mandible; at base rather broader than high, with large nasal tufts hiding the nostrils; culmen, commissure and gonys straight or nearly so (fig. 333.) Feet with the outer posterior longer than outer anterior toe; inner anterior intermediate between these. Wing long, pointed by the 4th, 3d and 5th quills; 2d decidedly shorter (shorter than 7th, except in *P. borealis*); 1st fairly spurious. Species of medium and small size, all black-and-white (one brown-backed), the back striped or barred, the wings with numerous small round white spots on the quills; ♂ with red on the head.

Analysis of Species and Varieties.

Back dark brown, neither striped nor fully barred with white . . . . . *stricklandi* 437
Back black, not striped lengthwise, but barred crosswise with white: "ladder-backs" (as in fig. 339).
  One large white space on side of head. Crown black . . . . . *borealis* 433
  Two white stripes on sides of head.
    Nasal feathers white; ♂ crown black, nape red, both white-spotted . . . . . *nuttalli* 435
    Nasal feathers brown; ♂ crown and nape red, both white-spotted.
      Outer web of outer tail-feather entirely black-barred . . . . . *scalaris* 434

Outer web of outer tail-feather partly black-barred . . . . . *lucasanus* 436
Back black, not barred crosswise, but striped lengthwise with white: "pole-backs."
Outer tail-feathers wholly white. Length usually 9-10 inches.
Greater coverts and inner secondaries profusely white-spotted . . . . . *villosus* 438
Greater coverts and inner secondaries sparsely or not white-spotted . . . . . *harrisi* 439
Outer tail-feathers barred with black. Length usually 6-7 inches.
Greater coverts and inner secondaries profusely white-spotted . . . . . *pubescens* 440
Greater coverts and inner secondaries sparingly or not white-spotted . . . . . *gairdneri* 441

433. **P. borea'lis.** (Lat. *borealis*, northern; inappropriate for a U. S. species. Fig. 331.) RED-COCKADED WOODPECKER. Body spotted and crosswise banded, but not streaked. Head black on top, with a large silky white auricular patch embracing the eye and extending on the side of the neck, bordered above in the ♂ by a scarlet stripe *not* meeting its fellow on the nape; nasal feathers and those on the side of the under jaw white; black of the crown connected across the lores with a black stripe running from the corner of the bill down the side of the throat and neck to be dissipated on the side of the breast in black spots continued less thickly along the whole side and on the crissum; under parts otherwise soiled white. Central tail-feathers black; others white, black-barred. Back and wings barred with black and white, the larger quills and many coverts with the white bars resolved into paired spots. ♀ lacking the red cockade. A peculiar isolated species; wings longer and more pointed than usual in this genus; 2d quill longer than 7th; spurious primary very short; bill smaller than usual, decidedly shorter than head. Length 8.00–8.50; extent 14.00–15.00; wing 4.50–4.90; tail 3.25–3.75. Pine swamps and barrens of the S. Atlantic and Gulf States; N. to Pennsylvania. Eggs 0.95 × 0.70.

FIG. 331. — Red-cockaded Woodpecker, nat. size. (Ad nat. del. E. C.)

434. **P. scala'ris.** (Lat. *scalaris*, ladder-like; *scala*, a scale, flight of stairs, etc.; alluding to the black and white cross-bars on the back.) TEXAN WOODPECKER. Entire back, from nape to upper tail-coverts, barred across in black and white stripes of equal width; a narrow space on back of neck, upper tail-coverts, and 4 middle tail-feathers, entirely black; wing-coverts with a round white spot at end of each feather, and a hidden spot or pair of spots further along the feather. Primaries regularly marked with white spots in pairs on the edges of the webs, those on the outer webs small and angular, on the inner webs larger and more rounded; on the secondaries these spots changing to broken bars; so that the primaries and coverts are spotted alike, the secondaries and back barred alike. Crown black, speckled with white, in the ♂ extensively crimson; the feathers being black, specked with white, finally tipped with red, which becomes continuous on the hind head, where the white specks cease. Side of head white, with a long black stripe from bill under eye, widening behind, there joining a black post-ocular stripe and spreading over side of neck. Nasal feathers smoky-brown. Under parts ranging from soiled white to smoky-gray, with numerous black spots on sides, flanks and crissum; lateral tail-feathers perfectly barred with black and white in equal amounts. ♀ lacking red on the crown. Small: length 7.00–7.50; extent 13.00; wing 3.50–4.00; tail 2.75–3.00; bill 0.66–0.87. Southwestern U. S. and southward, abundant. It is obviously impossible, in the cases of these profusely spotted woodpeckers, to frame a description which will meet every case, without being too vague, or going into tedious particulars. The foregoing, taken from Rio Grande specimens, covers the usual style of the species as found along our southern border; but the student must not be surprised if I fail to account for every spot of the particular specimen he has in hand.

435. P. s. nut'talli. (To Thos. Nuttall. Fig. 332.) NUTTALL'S WOODPECKER. Similar; rather larger; more white, this prevailing on the back over the black bars; nape chiefly white; nasal tufts white; lateral tail-feathers, especially, sparsely or imperfectly barred. The Californian coast race, differing decidedly in some respects, and constantly; but connected with general series of ladder-backs. Barring restricted to the back proper, the hind neck being black, succeeded anteriorly by a white space adjoining the red, wanting in *scalaris*, where red joins black. Red chiefly confined to the occiput, the rest of the crown black, spotted with white. Lateral tail-feathers white, not barred throughout, having but 1–3 black bars, all beyond their middles, all but the terminal one of these broken. White postocular stripe running into the white nuchal area, but cut off from the white of the shoulders. White maxillary stripe enclosed in black as in *scalaris*, but this black continuous with the cervical black patch, which is not the case in *scalaris*. No smoky-brown state of the under parts observed.

FIG. 332. — Nuttall's Woodpecker, nat. size. (From Elliot.)

436. P. s. lucasa'nus. (Of Cape St. Lucas.) ST. LUCAS WOODPECKER. A local race of *scalaris*. Smoky-brown nasal tufts and style of head and back as in that species. Lateral tail-feathers imperfectly barred and only toward end, as in *nuttalli*. Red of crown of ♂ broken up anteriorly. Peculiar in disproportionate size of bill and feet: bill 1.10; tarsus 0.75.

437. P. strick'landi. (To H. E. Strickland.) STRICKLAND'S WOODPECKER. Entirely different from any of the foregoing or following species. Adult ♂: Upper parts dark brown, immaculate; top of head, rump, and 4 middle tail-feathers black; the occiput with a scarlet band. Sides of head with white post-ocular and maxillary bands, expanded and more or less confluent on sides of neck. Wing-quills like the back, their outer webs with a few small white spots, the inner webs with more numerous larger white spots or broken bars. Outermost tail-feathers evenly barred throughout with blackish-brown and white; intermediate feathers partly so banded, but mostly blackish. Entire under parts sordid whitish, thickly spotted with dusky; the markings few and somewhat linear on the throat, crowded and cordate on the breast, widening and tending to become bars on the lower belly, flanks, and crissum. Bill and feet blackish-plumbeous. Size of a small *P. villosus;* wing 4.50; tail 3.25; bill 1.12; tarsus 0.75; middle toe and claw 0.90. ♀ similar: no red on nape; color of upper parts duller, and some feathers of middle of back barred with white. Young: Like adults of the respective sex; but top of head brown like back, and spotted with red. A Mexican species, lately ascertained to be of common occurrence in Arizona.

FIG. 333. — Hairy Woodpecker, nat. size. (Ad nat. del. E. C.)

438. **P. villo'sus.** (Lat. *villosus*, hairy, shaggy, villous. Fig. 333.) HAIRY WOODPECKER. Spotted and lengthwise streaked, but not banded. Usually 9–10 long; outer tail-feathers wholly white. Back black, with a long white stripe down the middle. Quills *and wing-coverts* with a profusion of white spots; usually 6–7 pairs on the primaries, several on all the secondaries, and one or more on each of the coverts. Four middle tail-feathers black; next pair black and white; next two pairs white, as stated. Under parts white. Crown and sides of head black, with a white stripe over and behind the eye; another from the nasal feathers running below the eye to spread on the side of the neck; a scarlet nuchal band in the ♂, sometimes broken in two, wanting in the ♀. Young with the crown mostly red or bronzy, or even yellowish. Eastern N. Am., abundant. Length usually 9.00–10.00; extent 15.50–17.50; wing 4.50–5.00; tail 3.50; bill 1.12; whole foot 1.66. Varies greatly in size, mainly according to latitude. In the West, shades directly into *P. v. harrisi*, by disappearance of the spots from the coverts and inner secondaries; the change occurs on the Eastern slopes of the Rocky Mts. One of the common Eastern U. S. woodpeckers, in British Am. trending westward to the Pacific in Alaska; but not so often noticed as the little *P. pubescens*, as it is less familiar, and keeps more in the woods. Resident wherever occurring. Eggs 4–6 or 7, 1.00 × 0.75.

a. major. Northern: very large and hoary. Length up to 11.00; wing over 5.00; tail nearly 4.00; whole foot 1.90; bill 1.50! (*P. leucomelas* Bodd.)

b. medius. The ordinary bird, as above.

c. minor. Southern: very small and dark. Grading down to 8.00, thus within an inch of the maximum of *P. pubescens*. (*P. auduboni* Sw.)

439. **P. v. har'risi.** (To Edward Harris.) HARRIS' WOODPECKER. Exactly like *villosus*, excepting fewer wing-spots; generally *none* on the coverts and inner quills; with specimens enough we can see the spots disappear one by one. Generally white below, but in some regions smoky-gray (a thing not observed in Eastern birds), such being especially the case on the Pacific slopes, where the smoky-bellied birds also sometimes acquire a few thin black stripes on the sides; those from the interior being quite purely white below. Size of an average *P. villosus*. Rocky Mts. to the Pacific, U. S.

440. **P. pubes'cens.** (Lat. *pubescens*, coming to puberty; i. e. hairy. Fig. 334.) DOWNY WOODPECKER. Usually 6–7 long; outer tail-feathers barred with black and white. Exactly like *P. villosus*, except in these respects. Length 6.00–7.00; extent 11.00–12.00; wing 3.50–4.00; tail under 3.00; bill about 0.66; whole foot 1.25. Eastern N. Am., abundant in orchards, and all wooded places. Range substantially the same as that of the hairy woodpecker, but in most U. S. localities the more abundant of the two; on the whole rather more southerly. This is the little spotted bird that bores the apple-trees so persistently; but it does not appear to hurt them. There is no such difference in the character of the plumage as the terms "downy" and "hairy" imply. Eggs about 6, 0.85 × 0.70.

FIG. 334. — Downy Woodpecker, nat. size. (Ad nat. del. E. C.)

441. **P. p. gaird'neri.** (To Dr. Meredith Gairdner, a Scotch naturalist.) Bearing the same relation to *P. pubescens* that *harrisi* does to *P. villosus;* the wing-spots few or wanting on the inner quills and the coverts, the belly smoky-gray in some localities. Rocky Mts. to the Pacific, U. S., but much rarer than *P. pubescens* is in the East, and almost wanting in much of the Rocky Mt. region, where *P. harrisi* abounds.

152. **XENOPI'CUS.** (Gr. *ξένος*, *xenos*, rare, foreign.) MASKED WOODPECKERS. Form as in *Picus* proper. Body uniformly black. Head white. Tongue said to be but little more extensible than in *Sphyropicus* (not verified by me).

442. **X. albolarva'tus**. (Lat. *albo*, with white, *larvatus*, masked.) WHITE-HEADED WOODPECKER. Body not banded, streaked, nor spotted. Uniform black; whole head white, in the ♂ with a scarlet nuchal band; a large patch of white on the wing, formed by white spaces on both webs of the primaries, divided only by their black shafts; on the secondaries commonly resolved into a number of blotches. Bill and feet plumbeous-blackish. Iris red. ♀ without the red on the nape. Length 8.75–9.50; extent 15.75–16.25; wing 5.00–5.25; tail 3.50. Mountains of California, Oregon and Washington, common in pine woods. A remarkable species, unique in coloration, and still more peculiar in the little extensibility of the tongue, which can be pulled out scarcely an inch; that of *P. villosus*, for instance, extending 2 inches or more beyond the end of the bill.

FIG. 335. — European Three-toed Woodpecker (*Picoïdes tridactylus*), ½ nat. size; hardly distinguishable in the cut from *P. americanus*. (From Brehm.)

153. **PICOÏ'DES** (Lat. *picus*, a woodpecker; Gr. εἶδος, *eidos*, resemblance. Fig. 335.) THREE-TOED WOODPECKERS. Three-toed: the hallux (1st toe) absent, the 4th toe reversed as usual in the family. Bill as in *Picus* proper, about as long as the head, stout, straight, with bevelled end and lateral ridges, and nasal tufts hiding the nostrils; very broad and much depressed at base, with the lateral ridges very low down, in most of their length close to and parallel with commissure; nostrils very near commissure; gonys about as long as from nostrils to end of bill. Wings very long and pointed; 1st quill spurious; 2d between 6th and 7th in length. Crown with a square *yellow* patch in the ♂; sides of head striped, of body barred, with black and white; under parts otherwise white; quills but not coverts with white spots; tail-feathers

unbarred, the outer white, the central black. All the species of this genus are unquestionably modified derivatives of one circumpolar stock; the American seem to have become completely differentiated from the Asiatic and European, and further divergence seems to have perfectly separated *arcticus* from *americanus;* but *dorsalis* and *americanus* are still linked together.

Analysis of Species.

Back uniform black . . . . . *arcticus* 443
Back with entirely interrupted lengthwise white stripe . . . . . *americanus* 444
Back with nearly or quite uninterrupted lengthwise white stripe . . . . . *dorsalis* 445

443. P. arc'ticus. (Lat. *arcticus*, arctic.) BLACK-BACKED THREE-TOED WOODPECKER. Entire upper parts glossy blue-black, with only a few white spots paired on the wing-quills. Below, white from bill to tail, the sides, flanks, and lining of wings barred with black. A slight or concealed white post-ocular stripe (often wanting) and a side-stripe on head from across forehead to neck, cut off by black from the white of the under parts. Four middle tail-feathers black, the rest white, but the intermediate one usually touched with black. ♂ with a square yellow patch on crown, wanting in ♀. Bill and feet blackish-plumbeous; iris brown. Length 9.00–10.00; extent 15.00–17.00; wing 5.00–5.50; tail 4.00; bill 1.25 or more. Northwestern Am., S. in winter through New England and generally along the northern tier of U. S., in the mountains of the West to about 39° in Nevada and California. Habits of ordinary *Picus*. Eggs 0.92 × 0.72.

444. P. america'nus. (Of America.) LADDER-BACKED THREE-TOED WOODPECKER. Upper parts black, the middle line white, more or less completely barred across with black; the general effect thus of a "ladder-back." All the primaries and secondaries with paired white spots or bars. Four middle tail-feathers black, others white, the intermediate one usually touched with black. Below, white from bill to tail, the sides, flanks, and lining of wings black-barred. A white post-ocular stripe to nape, and a larger white stripe from lore to side of neck. ♂ with a yellow square on crown, wanting in ♀; in both, crown seldom uniform black. Bill and feet blackish-plumbeous; iris brown. Smaller than the last; length 8.00–9.00; extent 14.00–16.00; wing 4.50–5.00; tail under 4.00; bill 1.25 or less; whole foot 1.50. Northern N. Am., S. to Massachusetts and along northern tier of States.

445. P. a. dorsa'lis. (Lat. *dorsalis*, relating to *dorsum*, the back.) POLE-BACKED THREE-TOED WOODPECKER. In extreme case, the back with an uninterrupted white lengthwise stripe, producing the effect of a "pole-back," as in *P. villosus* for instance; this is produced by such increase of white on the ends of the individual feathers that their black bases do not show, the subterminal black bars of *P. hirsutus* disappearing. Usually partly banded black and white, and grading bar by bar into *hirsutus*. The amount of spotting on the wings is about as in *Picus harrisi* — on primaries and secondaries, not on coverts. Size of *hirsutus*. Rocky Mt. region, U. S., S. to New Mexico.

154. SPHYROPI'CUS. (Gr. σφῦρα, *sphura*, a hammer; and Lat. *picus*.) SAP-SUCKING WOODPECKERS. Bill about as long as head, not so stout and chisel-like as in the foregoing genera; pointed, with little bevelling at extreme end only, and lateral ridges running obliquely into the commissure at about its middle; culmen and gonys both a little curved; nasal tufts moderate. Wing pointed by 4th primary; 3d and 5th nearly as long; 2d between 6th and 7th; spurious 1st very short. Tail-feathers long-acuminate. Outer hind toe little longer than outer front one; inner hind toe extremely short. Plumage highly variegated with yellow and red. Sexes unlike. Tongue scarcely extensile; the tip obtuse, brushy; hyoid bones short. Birds of this remarkable genus feed much upon fruits, as well as insects, and also upon soft inner bark (cambium); they injure fruit-trees by stripping off the bark, sometimes in large areas, instead of simply boring holes. Of the several small species commonly called "sapsuckers," they alone deserve the name. In declaring war against woodpeckers, the agriculturist will do well to discriminate between this somewhat injurious and the highly beneficial species.

446. S. va'rius. (Lat. *varius*, variegated. Fig. 336.) YELLOW-BELLIED WOODPECKER. ♂: Crown crimson, bordered all around with black; chin, throat, and breast black, enclosing a large crimson patch on the former (in the ♂; in the ♀ this patch white); sides of head with a white line starting from the nasal feathers and dividing the black of the throat from a trans-ocular black stripe, this separated from the black of the crown by a white post-ocular stripe; all these stripes frequently yellowish. Under parts dingy yellow, brownish and with sagittate dusky marks on the sides. Back variegated with black and yellowish. Wings black with a large oblique white bar on the coverts; the quills with numerous paired white spots on the edges of both webs. Tail black, most of the feathers white-edged, the inner webs of the middle pair, and the upper coverts, mostly white. Bill brownish; feet greenish-plumbeous; iris brown. Young birds lack the definite black areas of the head and breast, and the crimson throat-patch, these parts being mottled gray; but in any plumage the bird is recognized by its *yellowness*, different from what is seen in any other Eastern species, and the broad white wing-bar, to say nothing of the generic characters. Length 8.25–8.75; extent 15.00–16.00; wing 4.80–5.20; tail 3.50. Eastern N. Am., abundant in most U. S. localities, resident in the South, migratory northerly; N. to 61° at least; W. to Dakota; S. into Central Am. and W. I. The hyoid bones are the shortest of those of any N. Am. species; the tongue is protrusible only about $\frac{1}{8}$ inch beyond bill. Eggs 4–6, about 0.95 × 0.70.

FIG. 336. — Yellow-bellied Woodpecker, nat. size. (Ad nat. del. E. C.)

447. S. v. nucha'lis. (Lat. *nuchalis*, pertaining to *nucha*, the nape; not classic.) NUCHAL WOODPECKER. Like the last; with an additional band of scarlet on the nape (where the white is seldom even tinged with red in *S. varius*); red throat-patch invading the surrounding black, and ♀ with this patch at least in part red; all the yellowish variegation very pale, almost white on the belly (where *varius* is yellowest); bill slaty-black (not brownish). Size of *varius*. Rocky Mt. region, U. S., abundant. In *S. varius* the red rarely spreads on the nape, and the ♀ seldom has any on the throat. In *S. nuchalis* this extension of red is a step which culminates in *S. ruber*.

448. S. v. ru'ber. (Lat. *ruber*, red.) RED-BREASTED WOODPECKER. Like the last, but whole head, neck, and breast carmine-red, in both sexes, in which the markings of *varius* are more or less completely dissolved, though usually traceable; gray in the young. Size of the last. Pacific coast region, U. S. A remarkable extreme, long supposed to be perfectly distinct; now known to intergrade in every degree with *nuchalis*.

FIG. 337. — Brown-headed Woodpecker (♀), nat. size. (Ad nat. del. E. C.)

449. S. thyroï'des. (Gr. θυρεοειδής, *thureoeides*, shield-like; θυρεός, *thureos*, a shield; εἶδος, resemblance; alluding to the black plastron of the ♀. Figs. 337, 338.) BROWN-HEADED

WOODPECKER (♀). BLACK-BREASTED WOODPECKER (♀). RED-THROATED WOODPECKER (♂). WILLIAMSON'S WOODPECKER (♂). Adult ♂: Glossy black, including all the tail-feathers. Belly gamboge yellow. A narrow scarlet patch on the throat. Upper tail-coverts, a broad oblique bar on the wing-coverts, a post-ocular stripe, a stripe from nostrils below eye and ear, and small, in part paired, spots on the quills, white. Lining of wings, sides of body, flanks and crissum varied with white, leaving the black in bars and cordate spots. Bill slate-color; feet greenish-gray; iris reddish-brown. Length 9.00–9.50; extent 16.00–17.00; wing 5.00–5.50; tail 3.75; bill 0.90; whole foot 1.67. Adult ♀: Altogether different; only upper tail-coverts white and belly yellow as in ♂; only continuously black in a shield-shaped area on breast of varying extent. Otherwise, entire body, including wing-coverts, inner secondaries and most tail-feathers, closely and regularly barred crosswise with black and white, or brownish-white (most brownish on body, quite white on wings and tail). Whole head uniform hair-brown, invaded more or less with the variegation of the body, sometimes with traces of the post-ocular stripe of the ♂, and often touched with red on the throat. Quills more heavily white-spotted than in ♂, the spots paired on all the feathers, changing to bars on the inner ones. Two or three intermediate tail-feathers black, but middle and one or two outer pairs barred. Size of the ♂. The extraordinary sexual differences long kept *thyroïdes* and "*williamsoni*" apart in the books as perfectly distinct species; especially as they begin with the first featherings, fledglings in the nest showing the opposite patterns perfectly. Young ♂: Like adult; no red in the white throat-patch; belly merely yellowish; tail varied with white. Young ♀: Like adult, but whole head, neck, and breast banded with dusky and gray, conformable with the general variegation of the body. The best ♀ ♀ are those with the cleanest brown head and most black breast. Though the general effect of this beautiful woodpecker is so peculiar, in each sex, the coloration is referable to the *pattern* of *S. varius*. In both, yellow belly, red throat (♂), white upper tail-coverts, spotted quills, varied flanks and crissum, stripes on head, black breast (only circumscribed in ♀), white oblique wing-bar (only developed in ♂), variegation of inner web of middle tail-feather (♀ and young ♂); general variegation of back of *varius* repeated in ♀, while gray head of young *varius* is met by brown head of ♀ *thyroïdes*. Rocky Mts. to the Pacific, U. S., chiefly in the pine-belt, of which it is one of the characteristic species, like Clarke's crow, Steller's jay, and other birds; abundant in favorable localities. It is strictly a *Sphyropicus*, with little extensible, brushy and obtuse tongue, and feeds on juices of trees, as well as insects and berries. Eggs not yet taken: doubtless indistinguishable from those of *S. varius*.

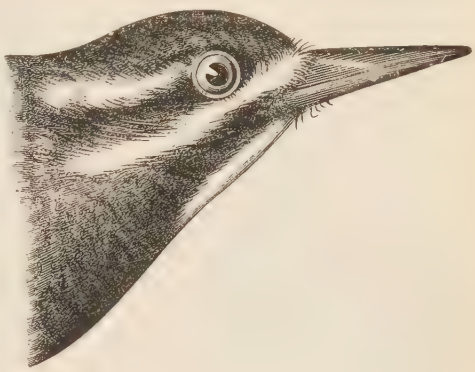


FIG. 338.—Red-throated Woodpecker (♂), nat. size (Ad nat. del. E. C.)

155. **CENTU'RUS**. (Gr. κέντρον, *kentron*, a prickle; οὐρά, *oura*, tail; but the species not sharper-tailed than other woodpeckers.) ZEBRA WOODPECKERS. Bill about as long as head, compressed, little bevelled or truncate at end, with decidedly curved culmen; lateral ridges near culmen, subsiding before reaching end of bill; nasal tufts moderate, partly concealing nostrils. Outer hind toe shorter than outer anterior one. Wings and tail ordinary. Sexes alike, except less or no red on head of ♀. "Ladder-backed;" back and wings, except larger quills, closely banded with black and white; primaries with large white blotches near the base, and usually a few smaller spots; below, immaculate, except sagittate black marks on the flanks and crissum: the belly tinged with red or yellow; 9–10 long; wing about 5.00; tail about 3.50.

Analysis of Species.

Belly reddening; no yellow about head; ♂ whole crown red; ♀ nape red . . . . . *carolinus* 450
Belly yellowing; ♂ crown-spot red; ♀ no red on head.
Front and nape yellow; rump entirely white; tail almost entirely black . . . . . *aurifrons* 451
No yellow on head; rump and tail much barred with black and white . . . . . *uropygialis* 452

450. C. caroli'nus. (Of Carolina. Fig. 339.) RED-BELLIED WOODPECKER. Whole crown and nape scarlet in the ♂; nape only so in the ♀. Sides of head, and under parts, grayish-white, usually with a yellow shade, *reddening* on the belly; tail black, one or two outer feathers white-barred; inner web of central feathers white with black spots, outer web of the same black with a white space next the shaft for most of its length; white predominating on the rump. Bill and feet dusky plumbeous. Iris red. Large; length nearer 10.00 than 9.00; extent 16.50–17.50; wing 5.00–5.50; bill over 1.00; ♀ smaller. Varies much in size; Southern specimens smaller than Northern. Eastern U. S., somewhat southerly, rarely N. to New England, and Canada West; W. to the Rocky Mts.; Texas; common southerly, where resident, less so northerly, where migratory. Eggs 4–6, 1.00 × 0.87.

FIG. 339. — Red-bellied Woodpecker, reduced. (Sheppard del. Nichols sc.)

451. C. au'rifrons. (Lat. *aurum*, gold; *frons*, forehead.) YELLOW-FRONTED WOODPECKER. Somewhat similar to the last: belly yellowish, not reddish; red of head in ♂ confined to a crown-patch, in ♀ wanting. Forehead and nasal plumes golden-yellow; nape with a golden, orange, or reddish band (in both sexes, besides the scarlet crown-patch of the ♂). Ladder-rungs of back narrow, numerous, and distinct. Head and under parts clear ashy-gray, very different from the smoky-gray of *C. uropygialis*, the belly yellowish, the flanks and crissum whitish, varied with black. Upper tail-coverts white, not barred. Middle tail-feathers entirely black; outermost not entirely barred; next black or only touched with white. Bill and feet bluish-black. Iris red. Length 9.50–10.50; extent 16.50–17.50; wing 5.00–5.50; tail 3.25–3.75. ♀ differs as said. Young ♂: Distinctively like the adult; nearly all the crown bronzy-red; nasal plumes not yellow; nape dull yellowish; a few thin streaks of dusky on breast. Texas and southward; very abundant in suitable localities on the Lower Rio Grande. Habits not peculiar. Eggs 4–6, 1.00 × 0.80.

452. C. uropygia'lis. (Gr. *οὐροπύγιον*, *ouropugion*, Lat. *uropygium*, the rump; banded in this species, not white as in *aurifrons*.) GILA WOODPECKER. SAGUARO WOODPECKER. Head all around and entire under parts fulvous-gray, with front and nape not notably different, the middle of the belly yellowish, the flanks and crissum whitish with black bars and cordate spots; middle of crown crimson in ♂. Back, rump, upper tail-coverts, wing-coverts, and inner quills closely and regularly banded with black and white, latter not pure on dorsal region. Primaries blackish, not regularly barred or spotted like the inner quills, but slightly white-tipped and -edged, and with large white blotches at base, of irregular shapes and tending to resolve into sets of smaller spots. Middle pair of tail-feathers black, with long white shaft-space on outer

web, on inner web white with black bars and spots; intermediate tail-feathers black; outermost regularly barred with black and white; next to outermost thus barred at end only. Bill blackish; feet plumbeous; iris probably red. Size of the others, or rather less. ♀ without red on head. A peculiar species, abounding in the valley of the Gila and Lower Colorado, and southward, where it nests usually in the giant cactuses.

156. **MELANER'PES.** (Gr. *μέλας*, *melas*, black; *ἕρπης*, *herpes*, a creeper.) TRICOLOR WOODPECKERS. Bill about as long as head, depressed at base, compressed beyond, culmen and gonys ridged but curved throughout, sides of upper mandible distinctly ridged but a little way, end of bill pointed with little bevelling; nasal tufts small, not concealing nostrils. Outer posterior and anterior toes of equal lengths. Wings pointed by 3d, 4th, and 5th quills; 2d shorter than 6th; 1st spurious. Plumage lustrous and "broad" in coloration, with black, white, and red in masses, little or not spotty or streaky. Sexes alike and young different, or sexes unlike and young similar. The two species are very different, requiring no analysis of their characters.

453. **M. erythroce'phalus.** (Gr. *ἐρυθρός*, *eruthros*, red; *κεφαλή*, *kephale*, head. Fig. 340.) RED-HEADED WOODPECKER. TRICOLOR. ♂ ♀, adult: Beautifully tricolor with "the red, white, and blue." Back, wings and tail glossy blue-black; secondaries, upper tail-coverts, under wing-coverts, under parts from the breast, and ends of some outer tail-feathers, white. Whole head, neck and fore breast crimson, usually black-bordered where adjoining the white. The white of the wings and rump is pure; that of belly usually tinged with ochraceous or reddish; the white quills have black shafts. The red feathers are stiffish and somewhat bristly in their colored portions. The gloss is sometimes green instead of blue. Bill and feet dusky horn-color. Iris brown. Length 8.50–9.50; extent 16.00–18.00; wing 5.00–5.50; tail 3.50; bill 1.00–1.12; whole foot 1.67. ♂ ♀, young: The red parts of the adult gray, streaked with dusky; the red appears in irregular patches. Feathers of back and wing-coverts skirted with light gray, and mixed with concealed whitish, in bars. Primaries and tail-feathers tipped and edged with white. White of secondaries broken with black bars or spots. At a very early age, whole under parts streaked with dusky much like the head, but these parts whiten before the head reddens. Eastern U. S. and British Provinces, irregularly rare or common northerly, abounding in most U. S. localities; common N. to 49° along Red River of the North; W. to Rocky Mts., sometimes to Utah and California; migratory in most sections. A very familiar bird, in orchards and gardens as well as in the woods, conspicuous with its gay tricolor plumage, and a great genius, no less brilliant and versatile in character than in plumage — very accomplished, of endless resources, with tricks and manners enough to fill the rest of this volume with good reading matter! Feeds much on acorns, nuts, berries, and various fruits as well as upon insects, and sometimes lays up a store, like the Californian Woodpecker. Nest anywhere in wood, preferably the blasted top of a tree. Eggs 5 or 6, glassy and spheroidal as usual in the family, 1.10 to 1.15 long, 0.80 to 0.90 broad. Two broods southerly.

FIG. 340. — Red-headed Woodpecker, reduced. (Sheppard del. Nichols sc.)

454. **M. formici'vorus bairdi.** (Lat. *formica*, an ant; *voro*, I devour. To S. F. Baird; our species a variety of the Mexican one. Fig 341.) CALIFORNIAN WOODPECKER. ♂ ♀: Glossy blue-black; rump, bases of all the quills, edge of the wing, and under parts from the breast, white; sides with sparse black streaks; forehead squarely white, continuous with a stripe down in front of the eyes and thence broadly encircling the throat, there becoming yellowish; this cuts off the

black around base of bill and on the chin completely; crown in the ♂ crimson from the white front, in the ♀ separated from the white by a black interval; frequently a few red feathers in the black breast-patch, which is not sharply defined behind, but changes by streaks into the white of the belly. Bill black; eyes white, often rosy, creamy, yellowish, milky, bluish, or brown. Young not particularly different, but have the head-markings less defined, the red bronzy. In the ♀, the succession of white, black, and red on the crown is very sharp and square. In some specimens of either sex, the secondaries are edged and tipped with white. The gloss is sometimes rather green than blue. Size of the last. Bill varies in size from 0.87 to 1.12! Rocky Mts. to the Pacific, U. S., abundant; noted for its habit of sticking acorns in little holes that it digs in the bark for the purpose; whole branches are frequently studded in this manner. General manners and bearing those of the common red-head. Eggs 1.10 × 0.90.

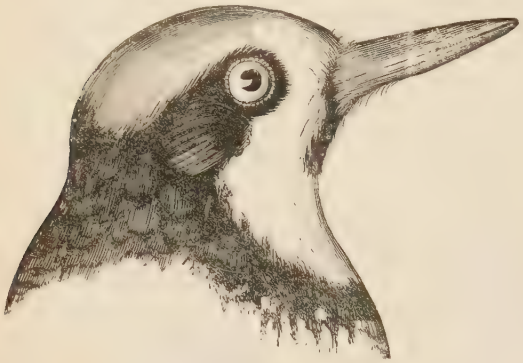


Fig. 341. — Californian Woodpecker, nat. size (Ad nat. del. E. C.)

455. M. f. angus'tifrons. (Lat. *angustus*, narrow, straitened; *frons*, forehead.) Narrow-fronted Woodpecker. Said to have the white frontal bar narrower; bill somewhat differently shaped; white bar narrower than the black one of the ♀, both together less than the red. L. California.

157. ASYNDES'MUS. (Gr. *a* privative, *σύν*, *sun*, together; *δεσμός*, *desmos*, a bond; alluding to the loosened texture of the feathers of certain parts.) Bristle-bellied Woodpeckers. Bill almost colaptine in general aspect, but with short distinct lateral ridges as in *Melanerpes;* as long as head, rather longer than tarsus, not broader than high at base, compressed and somewhat curved toward end; pointed with scarcely any lateral bevelling, culmen curved and scarcely ridged; gonys straight. Wings of excessive length, folding nearly to end of tail, and peculiar in proportion of primaries: 4th quill longest, 3d and 5th about equal and shorter than 2d. Inner anterior claw reaching little beyond base of outer anterior. Feathers of under parts and of a nuchal collar with the fibrillæ of their colored portions enlarged in calibre, bristly, of silicious hardness, loosened and disconnected, being devoid of barbicels and hooklets. Dorsal plumage compact, of intense metallic lustre. Feathers of face soft and velvety. Sexes alike; young different. I do not see why my friends have snubbed this genus; it is a good one, as genera go now.

Fig. 342. — Lewis' Woodpecker, nat. size. (Ad nat. del. E. C.)

456. A. torqua'tus. (Lat. *torquatus*, collared. Figs. 342, 343.) Lewis' Woodpecker. Collared Woodpecker. ♂ ♀, adult: Upper parts, including wings and tail, flanks and crissum, green-black with intense bronzy lustre, especially on the back — this iridescence like that of *Quiscalus æneus* almost. Face dark crimson, in a patch of velvety feathers around bill and eyes

A narrow distinct collar around back of neck, and breast, hoary bluish-gray, gradually brightening behind on the under parts to intense rose-red or lake, delicately pencilled in hair lines with the hoary-gray. No white on wings or tail, their under surfaces simply black. Bill blackish; feet greenish-plumbeous. Iris brown. Length 10.00–11.00; extent 20.00–22.00; wing 6.50–7.00; tail 4.50; bill 1.20. Young: Little lustre at first, but this soon appears, before any red. Little or no trace of the hoary collar or crimson mask; face sooty-black; throat and breast mixed fuscous and gray, changing on the belly to sooty-black, tinged or slashed here and there with red. The hoary and lake-red are established with the feathers that are of the bristly character above described. A remarkable bird, inhabiting wooded mountainous parts of the West, especially the pine-belt, Rocky Mts. to the Pacific, U. S. and British Columbia. It is found with Clarke's crow and Steller's jay; wild and wary, like our *Hylotomus;* keeps high up in the trees, and in flying looks more like a crow than a woodpecker. Its aerial excursions are very conspicuous. Nest and eggs as usual; size of eggs 1.12 × 0.95.

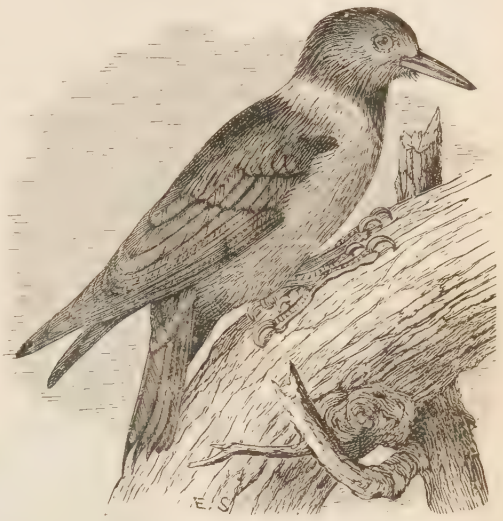


FIG. 343. — Lewis' Woodpecker, reduced. (Sheppard del. Nichols sc.)

158. **COLAPTES**. (Gr. κολαπτής, *kolaptes*, a chisel, hammer.) GILDED WOODPECKERS. FLICKERS. Bill about as long as head, slender and weak for this family, without any lateral ridges or bevelling, pointed without truncation, culmen and commissure curved, gonys nearly straight, only about half as long as culmen, nostrils not concealed by the slight nasal tufts; culmen and gonys, however, both ridged. Outer posterior toe shorter than the outer anterior; inner posterior very short. Wings long, pointed by 3d to 6th quills; 2d shorter than 7th; 1st about $\frac{2}{5}$ the 2d. Tail lengthened. Sexes generally alike, but distinguishable by positive marks about head. Plumage highly variegated and very showy. Under parts with numerous circular black spots on a pale ground. A large black pectoral crescent. Rump snowy-white. Back, wing-coverts and innermost quills brown with an olive or lilac shade, and thickly barred with black; quills and tail black, excepting as below stated; red or black cheek patches in ♂, wanting in ♀. About a foot long; wing about 6.00; tail 4.50. A beautiful genus, of 6 American species, 3 of N. Am.

FIG. 344. — Flicker, nat. size. (Ad nat. del. E. C.)

Analysis of Species.

Red moustaches in ♂; no red on nape in ♂♀; wings and tail orange-red underneath; cap lilac-brown; throat ashy; no yellow on belly; back umber-brown (Western) . . . . . *mexicanus* 459
(Mixed in every degree with)
Black moustaches in ♂; red nuchal crescent in ♂; wings and tail golden-yellow underneath; cap ashy; throat lilac-brown; yellow on belly; back olive-brown (Eastern) . . . . . *auratus* 457
(Not mixed with)
Red moustaches in ♂; no red on nape in ♂♀; wings and tail golden-yellow underneath; cap lilac-brown; throat ashy; yellow on belly; back umber-brown (Southwestern) . . . . . *chrysoïdes* 458

FIG. 345. — Golden-winged Woodpecker, ½ nat. size. (From Brehm.)

OBS. It will be noted, how curiously these species are distinguished mainly by a different combination of common characters. — *Colaptes auresi* AUD., *C. hybridus* BAIRD, *C. auratomexicanus* SUNDEVALL, is a form from the Missouri and Rocky Mt. regions in which the characters of *mexicanus* and *auratus* are blended in every conceivable degree in different specimens. Perhaps it is a hybrid, and perhaps it is a transitional form, and doubtless there are no such things as species in Nature. Eastern specimens of *auratus* sometimes show red touches in the black maxillary patch, as is frequently the case with Kansas examples. In the West, yon

will find specimens *auratus* on one side of the body, *mexicanus* on the other, — tail gilded on some feathers, rubricated on others, etc.

457. **C. aura/tus.** (Lat. *auratus*, golden, gilded. Figs. 344, 345.) GOLDEN-WINGED WOODPECKER. PIGEON WOODPECKER. FLICKER. YUCKER. HIGH-HOLDER. Back and exposed surfaces of wing-coverts and secondaries olive-brown with numerous black bars. Rump snowy-white; upper tail-coverts white, mixed with black. Primaries blackish, with golden shafts, and glossed with golden underneath, at their bases paler and more tawny yellow. Tail-feathers above black, their shafts and under surfaces golden, blackened at ends, the outermost with a few touches of yellow or white. Top of head, with back and sides of neck, ash, with a scarlet nuchal band (in both sexes). Sides of head, whole chin, throat, and fore-breast lilac-brown, with broad black cheek patches, these 'moustaches' wanting usually in the ♀. A broad black pectoral semilune. Other under parts shading from a lighter shade of the color of the breast into creamy-yellow, marked with numerous circular black spots. Bill and feet dark plumbeous. Iris brown. Length 12.00–13.00; extent 18.00–21.00, usually about 20.00; wing 5.75–6.25; tail 4.50; bill 1.25–1.50; whole foot 2.33. Young similar: more red on head. Eastern North Am.; keeping pretty straight to the upper Missouri, where, as said, adulterating with *mexicanus;* pure to the Pacific in Alaska. The first deviation is the appearance of red feathers in the black maxillary patches; these increase till they prevail, finally to the exclusion of the black, resulting in the wholly red patch of *C. mexicanus*. With this change occurs the diminution and final extinction of the scarlet nuchal crescent; when, coincidently, we find the characteristic golden-yellow on the wings and tail passing through an intermediate orange into the red of *mexicanus*, a change accompanied with another affecting the peculiar lilac-brown of the throat and olive-brown of the back, which become respectively ashen and purplish-gray. One of the most abundant and best-known species of the family, in any woodland, and sometimes foraging for food in open country far from trees; a great ant-eater. A lively bird, of sunny temperament, like its feathers, faithful and devoted, assiduous and successful in domestic affairs, and a good housekeeper. Eggs usually 6 or 7; under exceptional circumstances 18 to 23 have been taken from one hole; averaging 1.10 × 0.90. Migratory northerly.

458. **C. chrysoï/des.** (Gr. χρυσός, *chrusos*, gold; εἶδος, *eidos*, like.) GILDED WOODPECKER. Body, wings and tail, substantially as in *auratus;* head as in *mexicanus;* ♂ with scarlet moustaches; no red on nape in either sex; crown lilac-brown; chin, throat, and fore-breast ash; sides tinged with creamy-brown, belly with yellowish. There are, however, some specialties. Golden of wings and tail less vivid than in *auratus;* tail-feathers black for about half their length. General tone of under parts pale, without the decided tints of either of the other species, the round black spots large and crowded. Top of head purer and more cinnamon brown than in *mexicanus*. Smaller: wing about 5.50; tail about 4.00. Gradation between this form and *mexicanus* has not yet been observed. Valley of the Colorado River, Lower California and southward.

459. **C. mexica/nus.** (Of Mexico.) RED-SHAFTED WOODPECKER. MEXICAN FLICKER. Back, rump, and upper surfaces of wings and tail as in *C. auratus*, but a different shade of color, a faintly reddish replacing the olivaceous tinge of the ground-color. Wings and tail of the same pattern, but the auration replaced by rubefaction. Top of head rufous (like the throat of *auratus*); no occipital red crescent in either sex. Throat and sides of head and neck clear ash, with scarlet maxillary patches in the ♂. A black pectoral semilune. Under parts very pale lilac-brown, fading to whitish on the belly, marked with numerous round black spots. Bill blackish-slate; feet dark plumbeous. Iris brown. Size of *C. auratus*. Western North Am., mostly replacing the yellow flicker from the Rocky Mts. to the Pacific, Sitka into Mexico. In habits a perfect counterpart of the common flicker.

III. Order PSITTACI: Parrots.

FIG. 346. — Carolina Parroquet, reduced. (From Tenney, after Wilson.)

Feet permanently zygodactyle by reversion of the fourth toe, covered with rugose granular scales or plates; bill short, extremely stout, *strongly epignathous, and furnished with a* (frequently feathered) *cere*, as in the birds of prey; wings and tail variable. The parrots, including the macaws, cockatoos, lories, etc., form one of the most strongly marked groups of birds, as easily recognizable by their peculiar external appearance as defined by technical points of structure. They were formerly included in an "order" *Scansores* on account of the paired toes, but this is a comparatively trivial circumstance; they have no special affinity with other zygodactyle birds, and their peculiarities entitle them to rank with groups called orders in the present volume. They might not inaptly be styled *frugivorous Raptores;* and in some respects they exhibit a vague analogy to the quadrumana (monkeys) among mammals. The tongue is thick and fleshy, in some genera peculiarly brushy; it is used to some extent in *prehension*, objects being handled between the tongue and upper mandible. The upper mandible is much more freely movable than is usual in birds, being articulated instead of suturally joined with the forehead; and the bill is commonly used in climbing. The bony orbits of the eyes are frequently completed by union of the lachrymal bones with postorbital processes, and in some genera develop a bony bridge across the temporal fossa. The symphysis of the lower jaw is short and obtuse. The sternum is entire or simply fenestrated posteriorly; the furculum is weak, sometimes defective, or wanting. The principal metatarsal bone is short and broad, and its lower extremity is modified to suit the position of the fourth toe. The lower larynx is peculiarly constructed, with three pairs of muscles; the ability to articulate human speech is one of the most notorious faculties of some parrots. The plumage shows aftershafts; the oil-gland is wanting in certain genera; when present, it is tufted. There are no cœca, and the gall-bladder is wanting. Though the family is so perfectly circumscribed that no one doubts of any bird whether it be psittacine or not, parrots differ remarkably among themselves in certain structural characters which have in most birds a high classificatory value. Thus, there are three decided modifications of the carotid arteries — of which right and left may both be present, and both running deep in the vertebrarterial canal; or both may be present, but the left superficial; or only the left is developed (in *Cacatua*), as usual in birds. The ambiens muscle, again, may be present and normal, present and incomplete, or wanting altogether. The femoro-caudal muscle, semitendinosus, and accessory semitendinosus are present; the accessory femoro-caudal is absent.

The division of the *Psittaci* into family groups has taxed the ingenuity of ornithologists; for so variously interrelated are the numerous forms, that the grouping fluctuates with almost every character or set of characters selected for use in classification. But Garrod's admirable anatomical investigations show that the *Psittaci* may be ranged in two series, according to the

characters afforded by the carotid arteries and ambiens muscle. I. PALÆORNITHIDÆ: Carotids two (except in *Cacatua*), the left normal, and no ambiens. II. PSITTACIDÆ: Carotids two, the left superficial, the ambiens present in one series of genera, absent in others. In the subfamily (1) *Palæornithinæ*, there is no further deviation; in (2) *Cacatuinæ*, besides the lack of a right carotid in *Cacatua* itself, the orbital ring is completely ossified, and develops a bony process bridging in the temporal fossa; in (3) *Stringopinæ*, which includes the curious flightless ground Parrot or owl Parrot of New Zealand (*Stringops habroptilus*), the furculum and sternal keel are deficient or defective. *Psittacidæ* include (4) the *Arinæ*, in which the ambiens muscle

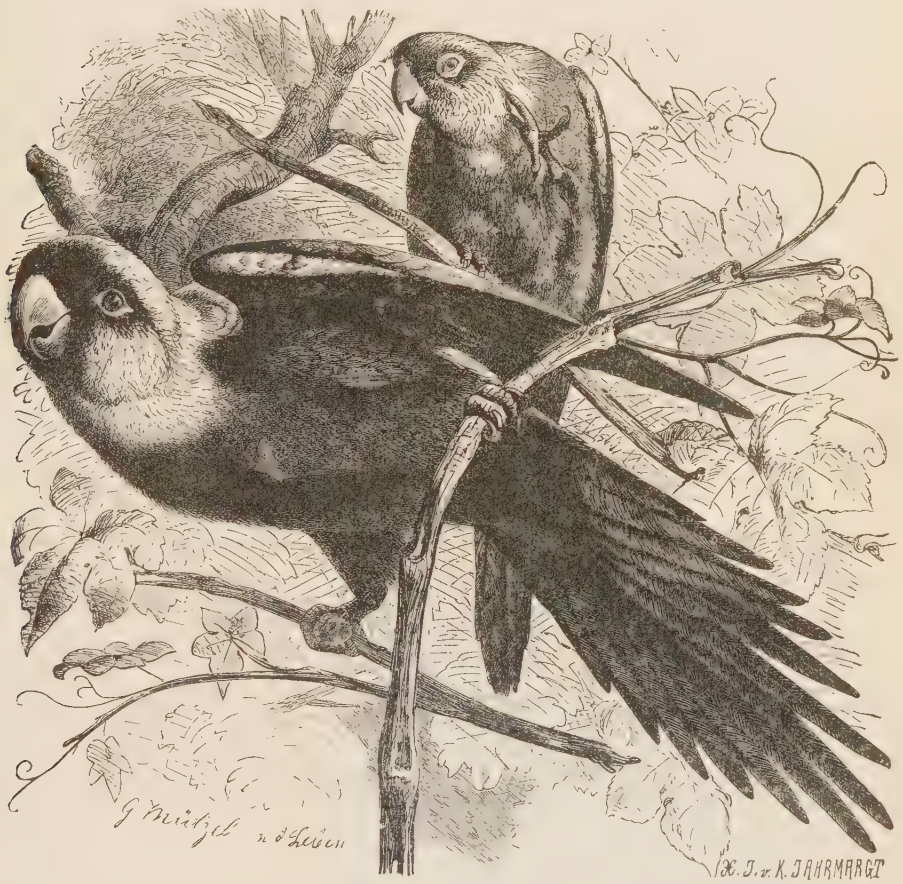


FIG. 347. — Carolina Parroquet, $\frac{1}{2}$ nat. size. (From Brehm, after Audubon.)

is present; (5) *Pyrrhurinæ*, in which it is absent, without further modification; (6) *Platycercinæ*, no ambiens and no furculum; (7) *Chrysotinæ*, no ambiens, no furculum, and no oil-gland. There are thus 7 subfamilies of 2 families of *Psittaci*.

"Parrots abound in all tropical countries, but, except in Australia and New Zealand, rarely extend into the temperate zone. The Indian and Æthiopian regions are poor in parrots, while the Australian is the richest, containing many genera and even whole families peculiar to it." (NEWTON.) The highest authority, FINSCH, recognizes 354 species as well determined, distributing them in 26 genera; 142 are American, 23 African, and 18 Asiatic; the Moluccas and New Guinea have 83, Australia 59, and Polynesia 29.

28. Family PSITTACIDÆ: Parrots.

See above. Two carotids, the left superficial. All New World Parrots belong here (but all *Psittacidæ* are not of the New World).

39. Subfamily ARINÆ: Parrots.

See above. Ambiens muscle, tufted oil-gland and complete furculum. Of this subfamily the Macaws (*Ara*) and our species of *Conurus* are characteristic.

159 **CONU'RUS.** (Gr. *κῶνος, konos*, a cone; *οὐρά, oura*, tail; cuneate-tail.) PARROQUETS. Tail lengthened, nearly equalling wings, cuneate, with tapering feathers. Face entirely feathered excepting a slight space about the eye. Nostrils in the feathered cere. Bill very stout, with bulging lateral outline, broadly rounded culmen, and toothed or lobed commissure. Tarsi very short, much less than the inner anterior toe; outer anterior longer than outer posterior toe. Feet granular-reticulate, becoming scutellate on the toes. Wings pointed; in our species the 2d and 3d primaries longest, the 1st and 4th subequal and shorter. A large genus of tropical America, with one U. S. species.

460. **C. carolinen'sis.** (Lat. Carolinian. Figs. 346, 347.) CAROLINA PARROQUET. Green; head yellow; face red; bill white; feet flesh-color; wings more or less variegated with blue and yellow. Sexes alike. *Young* simply green. Length 12.50–13.50; extent 21.00–22.50; wing 7.00–8.00; tail 6.00–7.00. Southern States; up the Mississippi Valley to the Missouri region; W. to Arkansas and the Indian Territory; recently Kansas, Nebraska, Iowa, etc.; formerly strayed to Pennsylvania and New York, but of late has receded even from the Carolinas; still abundant in Florida. But it would seem that if the cruel and wanton slaughter to which the gentle creatures are subjected by idlers goes on, they must before long be exterminated. Gregarious, frugivorous, and granivorous; not regularly migratory, but roving. Said to breed in companies in hollow trees; eggs whitish, 1.40 × 1.05, elliptical in shape, rough in texture.

IV. Order RAPTORES: Birds of Prey.

FIG. 348. — Death as a bird of prey. (From Michelet.)

Bill epignathous, cered; and feet not zygodactyle. The rapacious birds (*Raptores*, *Raptatores* or *Accipitres* of authors, *Aëtomorphæ* of Huxley) form a fairly natural assemblage, to which this expression furnishes a clew. (The parrots, probably the only other birds with strongly hooked and *truly* cered bill, are yoke-toed.) The *Raptores* present several osteological and other anatomical characters. The sternum is ample and deep keeled, its posterior margin doubly or singly notched or fenestrate on each side, or entire with central emargination; the furculum anchylosed or not. Angle of mandible not recurved; maxillopalatines united to an ossified septum; rostrum arched and hooked; basipterygoid processes

present or absent. Hallux always present, usually valid and insistent; outer toe reversible in some cases, never permanently reversed. The ambiens is present (except in *Striges*); all excepting *Gypogeranides* and some *Cathartides* possess the femoro-caudal muscle, but not its accessory, nor the semi-tendinosus nor its accessory (excepting *Cathartides*, which have the two last named, and *Gypogeranides*, which have these and the accessory femoro-caudal). Cœca are present (except in *Cathartides*). The oil-gland is present in all, and tufted except in *Cathartides*. Aftershafts are present (usually), lacking in some *Accipitres*, all *Striges* and *Cathartides*. There are two carotids; the syrinx, when developed, has but one pair of intrinsic muscles. The nature is altricial, yet ptilopædic, the young being downy when hatched, and long fed by the parents in the nest. The alimentary canal varies with the families, but differs from that of vegetarian birds, in adaptation to an exclusively animal diet. In the higher types, the whole structure betokens strength, activity, and ferocity, carnivorous propensities and predaceous nature. Most of the smaller, or weaker, species feed much upon insects; others more particularly upon reptiles, and fish; others upon carrion; but the majority prey upon other birds, and small mammals, captured in open warfare. To this end, the claws no less than the beak are specially adapted, by their development in the "talons" which we constantly associate with our ideas of birds of prey. These weapons of offence and defence are as a rule of great size, strength, crookedness, and acuteness; and also peculiar in being convex on the sides, gradually narrowed to the point, and little or not excavated underneath. The inner claw is larger than the outer, and the hinder one smaller than the middle; and all are very flexibly jointed, so that they may be strongly bent underneath the toes, carrying to the extreme the grasping power of the feet. The legs are muscular and largely free from the body, feathered to the suffrago or beyond; when unfeathered, the tarsal envelope varies in character. The wings are ample, and, as usual in birds below *Passeres*, the coverts are long and numerous, covering three-fourths or more of the folded wing. The tail, very variable in shape, has twelve rectrices (with rare exceptions).

Representatives of this order are found in every part of the world. They are divisible into *four* primary groups, of more classificatory value than that attaching to average families in ornithology, and therefore to be held as superfamilies or suborders. One of these, *Gypogeranides*, consists of the single remarkable species *Gypogeranus serpentarius*, the secretary-bird or serpent-eater of Africa; this shows a curious grallatorial analogy, being mounted on long legs like a Crane, and has several important structural modifications. The other three are the *Striges* or Owls; the *Accipitres* or Hawks, Eagles, etc., including the Old World Vultures; and the *Cathartides* or American Vultures, — these last more different from the others collectively than the rest are from one another. All are well represented in this country. They are recognizable at a glance, but the following analysis will serve to place the characters of the suborders and their respective families in strong relief.

Analysis of Suborders and Families.

Feet scarcely raptorial, with weak, blunt, lengthened, little curved or contractile claws. Hind toe elevated, not more than half as long as outer toe, with small claw; middle toe lengthened; outer toe not versatile; front toes all webbed at base; basal joint of middle toe longer than either of the succeeding ones. Nostrils large, perforate. Bill little raptorial, lengthened and somewhat contracted in continuity, tomia never lobed or toothed, tip blunt, little hooked. Head largely naked. Index digit with a large claw. No lower larynx, cœca, aftershafts, or tuft of oil-gland. Ambiens present; femoro-caudal present or absent; semitendinosus and its accessory present . . . . . CATHARTIDES.

Diurnal; gressorial; feed exclusively on carrion . . . . . CATHARTIDÆ.

Feet highly raptorial, with large, strong, sharp, curved, contractile claws. Hind toe not elevated, lengthened, more than half as long as outer toe, with large claw; outer toe often versatile; front toes with slight basal webbing between outer and middle, or none. Nostrils small, imperforate. Bill short, stout, very seldom contracted in its continuity, tomia often once or twice lobed or toothed, tip sharp, much hooked. Head feathered completely or in greatest part. Lower larynx with one pair of intrinsic muscles. Cœca present. Plumage with or without aftershafts. Ambiens present or absent. Femoro-caudal present. Semitendinosus and its accessory absent. As a rule, saltatorial, and kill their prey.

Physiognomy not peculiar; no great lateral expansion of the cranium or thickening of its walls with diploë; eyes looking sideways; no facial disc or only an imperfect one; base of bill not hidden by appressed feathers. Nostrils wholly in the cere. Tomia usually toothed or lobed. No external ear-conch. Outer toe not shorter than inner, and rarely versatile. Basal joint of middle toe longer than the next. Feet with rare exceptions mostly or entirely naked of feathers, scutellate or reticulate, or both; toes always bare and scaly. Sternum commonly single-notched or -fenestrate on each side, sometimes entire. Oil-gland tufted. Plumage compact, usually aftershafted; flight audible. Ambiens present. Diurnal . . . . ACCIPITRES.

Outer toe not reversible, and plumage usually aftershafted . . . . . FALCONIDÆ.

Outer toe reversible, and plumage without aftershafts . . . . . PANDIONIDÆ.

Physiognomy peculiar by reason of great lateral expansion, lengthwise contraction and diploïc thickening of the often unsymmetrical cranium; eyes looking forward, surrounded with a radiated disc of modified feathers, in front appressed, antrorse, hiding base of bill. Nostrils usually at edge of the cere. Tomia never lobed or toothed. A large external ear-conch often developed. Outer toe completely versatile, shorter than inner toe. Basal joint of middle toe not longer than second, much shorter than the penultimate one. Feet usually feathery or bristly to or on the toes. Oil-gland nude. Plumage without aftershafts, soft and lax; flight noiseless. Ambiens absent. Nocturnal . . . . . STRIGES.

Sternum entire behind, with central emargination; furculum anchylosed. Middle claw pectinate. Facial disc complete, triangular . . . . . ALUCONIDÆ.

Sternum double-notched or fenestrate; furculum free. Middle claw not pectinate. Facial disc circular when complete . . . . . STRIGIDÆ.

6. Suborder STRIGES: Nocturnal Birds of Prey.

Head very large, and especially broad from side to side, but shortened lengthwise, the "face" thus formed further defined by a more or less complete "ruff," or circlet of radiating feathers of peculiar texture, on each side. Eyes very large, looking more or less directly forward, set in a circlet of radiating bristly feathers, and overarched by a superciliary shield. External ears extremely large, often provided with an operculum or movable flap, presenting the nearest approach, among birds, to the ear-conch of mammals. Bill shaped much as in ordinary *Accipitres*, but thickly beset at base with close-pressed antrorse bristly feathers, and never toothed. Nostrils large, commonly opening at the edge of the cere rather than entirely in its substance. Hallux of average length, not obviously elevated in any case; outer toe more or less perfectly versatile (but never permanently reversed), and shorter than the inner toe; its first three joints very short, altogether not as long as the succeeding one; basal joint of middle toe not longer than the next. Claws all very long, much curved and extremely sharp, that of the middle toe pectinate in some species. As a rule, the tarsi are more or less completely feathered, and the whole foot is often thus covered. Among numerous osteological characters may be mentioned the frequent want of symmetry of the skull, wide separation of the inner and outer tablets of the brain-case by intervention of spongy diploë, the spongy maxillo-palatines and lacrymals, which latter long persist distinct; the basipterygoid processes; the manubriated and commonly 4-notched (if not entire) sternum; a peculiar structure of the tarso-metatarsus; a particular arrangement of the bones about the shoulder-joint, and the weakness of the furculum when not anchylosed with the sternum. The gullet is capacious but not dilated into a special crop; the gizzard is only moderately muscular; the intestines are short and wide; the cœca are extremely long and club-shaped. The syrinx has one pair of intrinsic muscles. The oil-gland is nude. The ambiens is absent. The feathers have no aftershaft, and the general plumage is very soft and blended.

The Nocturnal Birds of Prey will be immediately recognized by their peculiar physiognomy, independently of the technical characters that mark them as a natural, sharply-defined group. They are highly monomorphic, without extremes of aberrant form; but the ease with which they are collectively defined is a measure of the difficulty of their rigid subdivision, which is not yet satisfactorily determined. Too much stress has been laid upon the trivial, although evident, circumstance of presence or absence of the peculiar "horns" that many species possess.

These are tufts of lengthened feathers rising over the eyes from the forehead, and commonly called "ear-tufts"; but they have nothing to do with the ears, and are more appropriately named "plumicorns," or feather-horns. More reliable characters may be drawn from the structure of the external ear and facial disc, the modifications of which appear to bear directly upon mode of life; these parts being as a rule most highly developed in the more nocturnal species; some points of internal structure have been found correspondent. Thus, one group, of which the barn owl, *Aluco flammeus*, is the type, is very distinct in the angular contour and

FIG. 349. — "Est illis *Strigibus* nomen; sed nominis hujus
Causa quod horrendâ stridere nocte solent." — OVID, *Fasti*, vi. 139.

"*Screech-owls* they 're called, because with dismal cry
In darkling night from place to place they fly."

high development of the facial disc, pectination of the middle claw, and other characters upon which a family *Aluconidæ* may be established. Probably the rest of the suborder fall in two subdivisions of a single family *Strigidæ*, the essential characters of which have already been contrasted with those of *Aluconidæ*.

The nearest relatives of the *Striges*, outside their own order, are the *Caprimulgi* — the relationship being really very close through the genus *Steatornis*. As is well known, owls are eminently nocturnal birds; but to this rule there are numerous striking exceptions. This general habit is correspondent to the modification of the eyes, the size and structure of which

enable the birds to see by night, and cause them to suffer from the glare of the sunlight. Most species pass the daytime secreted in hollow trees, or dense foliage and other dusky retreats, resuming their wonted activity after nightfall. Owing to the peculiar texture of the plumage their flight is perfectly noiseless, like the mincing steps of a cat; and no entirely fanciful analogy has been drawn between these birds and the feline carnivora that chiefly prey stealthily in the dark. The nest is commonly a rude affair of sticks gathered in the various places of diurnal resort; the eggs are several (commonly 3–6), white, subspherical. The ♀, as a rule, is larger than the ♂, but the sexes are alike in color; the coloration is commonly blended and diffuse, difficult of concise description. Owls feed entirely upon animal substances, and capture their prey alive — small quadrupeds and birds, reptiles and insects, and even fish. Like most other *Raptores*, they eject from the mouth, after a meal, the bones, hair, feathers, and other indigestible substances, made up into a round pellet. They are noted for their loud outcries, so strange and often so lugubrious, that it is no wonder traditional superstition places these dismal night-birds in the category of things ill-omened. Besides the well-known lines which are set beneath two of the accompanying figures, the reader may recall the owl as among the 'portents weird' which foretell the fate of the unhappy queen of Carthage, when, deserted by 'pious' Æneas, she resolves to die.

> "Solaque culminibus ferali carmine *bubo*
> Sæpe queri, et longas in fletum ducere voces." — VERG., *Æn.*, iv. 462.
>
> The hoot-owl, brooding ominous above
> Her fateful house, is wearing dismal night away
> With wild vociferation. Portents weird, etc.

Owls are among the most completely cosmopolitan of birds; with minor modifications according to circumstances, their general habits are much the same the world over. A difficulty of correctly estimating the number of species arises from the fact that many, especially of the more generalized types, have a wide geographical distribution, and, as in nearly all such cases, they split into more or less easily recognized races, the interpretation of which is at present a matter of opinion rather than a settled issue. About 200 species pass current; this number must be reduced by one-third; out of about 50 generic names now in vogue, probably less than one-half represent some structural peculiarity.

29. Family ALUCONIDÆ: Barn Owls.

FIG. 350. — Barn Owl. (From Dixon.)

Two genera of Owls, *Aluco* and *Phodilus*, differ so much from other *Striges* that they may properly constitute a family apart from *Strigidæ*. The prime character is anchylosis of the furculum with the sternum, which latter bone is entire behind (unusual; compare fig. 56). External characters are: facial disc and outer ear-parts highly developed, the former not circular, but rather triangular, the latter symmetrical; middle and inner toes of about equal lengths; inner edge of middle claw serrate or jagged, simulating the pectination seen in *Caprimulgidæ*, to which birds these owls are curiously related through *Steatornis*. The pattern of coloration is peculiar; the plumage is very downy; the habits of the species are eminently nocturnal. The leading genus, *Aluco*, of several species or races, is nearly cosmopolitan, being absent only from high latitudes and some insular regions; the other, of one species, *Phodilus badius*, inhabits portions of Eastern Asia, Ceylon, Java and Borneo. — N. B Adoption of the name *Aluco* for the Barn Owls, instead of *Strix*, requires the present family to

be called *Aluconidæ*, instead of *Strigidæ;* which latter name is to be applied to the succeeding family.

160. **ALU'CO.** (Ital. *alocho*, some kind of owl. Figs. 47, 351.) BARN OWLS. To above characters add: Wings very long, pointed, folding beyond the tail, the 1st or 2d primary longest, and none emarginate. Tail short, nearly even or emarginate, about ½ as long as the wing. Tarsus nearly twice as long as middle toe without claw, closely feathered, the plumage becoming scant and

FIG. 351. — Barn Owls, ⅛ nat. size. (From Brehm.)

"From yonder ivy-mantled tower,
The moping owl does to the moon complain
Of such, as wand'ring near her secret bower,
Molest her ancient solitary reign." — GRAY.

bristly below, like that on the nearly naked toes, and reversed in direction on the posterior aspect; claws extremely long and acute (see fig. 47). Bill lengthened, compressed, the cere nearly as long as the rest of the culmen; nostrils oval; no plumicorns; eyes comparatively small, black; bill light-colored; plumage flagrant, not dichromatic; size medium. One North Am. species.

425. A. flammeus pratincola (Lat. *flammeus*, flame-colored; *pratincola*, meadow-inhabiting.) BARN OWL. Above, including upper surfaces of wings and tail, tawny, fulvous, or orange-brown, delicately clouded or marbled with ashy and white, and dotted with blackish, sometimes also with white; such marking resolved, or tending to resolve, into four or five bars of dark mottling on the wings and tail. Below, including lining of wings, varying from pure white to tawny, ochrey, or fulvous, but usually paler than the upper parts and dotted with small but distinct blackish specks. Face varying from white to fulvous or purplish-brown, in some shades as if stained with claret, usually quite dark or even black. About the eyes, and the border of the disc, dark brown. Thus extremely variable in tone of coloration, but the pattern more constant, while the generic characters render the bird unmistakable. Nestlings are covered with fluffy white down. Length 15.00–17.00; extent about 44.00; wing 13.00–14.00; tail 6.00–7.00; bill 0.95; tarsus 2.75. ♀ larger than ♂. The superior size is the chief distinction from the Old World *A. flammeus*. U. S. from Atlantic to Pacific; somewhat southerly, only known N. to Massachusetts and corresponding latitudes; S. into Mexico, West Indies and Central America; abundant in wooded, settled, and especially maritime regions; usually resident. Breeds naturally in hollow trees, frequently in the barn, belfry, tower, or other building; eggs 3–6 in number, colorless or soiled yellowish-white, about 1.75 × 1.25, nearly equal-ended, laid with little or no preparation upon the débris of the hole, commonly bones and other refuse of the food, which is chiefly small quadrupeds and insects.

30. Family STRIGIDÆ: Other Owls.

FIG. 352. — Mobbing an owl. (From Michelet.)

All other *Striges*, as far as known, have the sternum once or twice notched on each side behind, and the furculum free from that bone. The outer ear-parts are sometimes as highly developed as in *Aluconidæ*, or they may be quite small; the facial disc varies in size and perfection, being largest, most circular, and most completely radiating from the eye as a centre in those species in which the ear-conch is best developed. These two characters would therefore seem to go together, and they are not correlated with the presence or absence of plumicorns. The inner toe is shorter than the middle, and the middle claw is not pectinate. It may prove advisable to make these features the basis of a division of the *Strigidæ* into two subfamilies, *Striginæ* and *Buboninæ*, as proposed by Mr. Sharpe; but I do not deem it expedient to present such arrangement on the present occasion. In the event of such final determination, our genera *Strix*, *Asio*, and *Nyctala* would fall in *Striginæ;* the rest in *Bubonineæ*.

Analysis of Genera.

(40) STRIGINÆ? Eye centric in large complete circular disc, and ear-conch larger than eye, with well developed operculum.

Plumicorns absent: cere short.

Ear-parts symmetrical. Large: length over 12 inches . . . . . *Strix* 164

Ear-parts asymmetrical. Small: length under 12 inches . . . . . *Nyctala* 167

Plumicorns present: cere longer than rest of culmen . . . . . *Asio* 163

(41) BUBONINÆ? Eye eccentric, nearer top than bottom of more or less incomplete disc, and ear-conch not larger than eye, without developed operculum.

Plumicorns present, well-developed.

Very large: length over 18 inches; tail about ⅔ the wing . . . . . *Bubo* 161

Small: length under 12 inches; tail about ½ the wing . . . . . *Scops* 162

Plumicorns present, rudimentary. Very large: length over 18 inches. White . . . . . *Nyctea* 165

Plumicorns absent.

Tarsus full-feathered.

Tail graduated. Length over 12 inches. Hawk-like . . . . . *Surnia* 166

Tail rounded. Length much under 12 inches . . . . . *Glaucidium* 168

Tarsus naked or scant-feathered.

Length under 8 inches . . . . . *Micrathene* 169

Length over 8 inches . . . . . *Speotyto* 170

161. BU'BO. (Lat. *bubo*, the horned owl.) THE GREAT HORNED OWLS. HOOT OWLS. Skull and ear-parts symmetrical (of same size on both sides of head), the latter simply elliptical, non-operculate, not longer than the great yellow eye, which is eccentric in the moderately developed facial disc (nearer its top than bottom). Plumicorns highly developed. Nostrils oval, in the edge of the cere, which is not inflated, nor as long as the rest of the culmen; bill robust, black, not buried in the frontal bristles. Wings rather short, folding short of the end of the tail, the 3d or 4th primary longest, the first 2 or 3 emarginate near their ends. Tail rounded, more than ½ as long as the wing, its under coverts not reaching its end. Feet densely feathered to the last joint of the toes, but claws exposed. Of medium and very large size (some of the species are nearly the largest of the owls), and variegated, usually dark, colors; plumage not dichromatic. Embracing numerous species, of all America and nearly all of the Old World; only one, however, in N. Am.

FIG. 353. — Great Horned Owl, much reduced. (From Tenney, after Audubon.)

462. B. virginia'nus. (Lat. *virginianus*, Virginian. Fig. 353.) GREAT HORNED OWL. HOOT OWL. CAT OWL. Distinguished by its large size and conspicuous ear-tufts, our other species of similar stature being tuftless or nearly so. Length nearly or about two feet; extent 4 or 5 feet; wing 14.00–16.00 inches; tail 8.00–10.00; tarsus 2.00–2.25; culmen without cere 1.10–1.20. ♀ averaging larger than ♂. Plumage varying interminably, no concise description meeting all its phases. A white collar on the throat is the most constant color-mark. On the upper parts, the under-plumage tawny, but so overlaid with coarse mottling of blackish and white, that it shows chiefly on the head, nape, and scapulars; the mottling chiefly transverse, and resolving into 7 to 9 continuous or broken bars on the wings and tail. Under parts white, indefinitely tawny-tinged, and for the most part barred crosswise with blackish, changing on the fore breast to ragged and rather lengthwise blotches. Feathering of feet nearly plain tawny. Ear-tufts black and tawny; a dark mark over eye; border of the facial disc black, the face white or tawny, but the feathers mostly black-shafted. Bill and claws black; iris yellow; pupil always circular; when fully dilated as large as a finger-ring, contractile to the size of a pea. Young covered at first with white down; first plumage more uniformly tawny and lighter-colored than it becomes after the first moult, when the white collar and other distinctive markings are assumed. This powerful bird, only

yielding to the great gray owl in stature, and to none in spirit, is a common inhabitant of North Am. at large, representing *B. ignavus* of Europe. It is non-migratory; breeds in late winter, and early spring months (usually February or March), laying in hollows of trees or rifts of rocks, or in a bulky nest of sticks on the branches of tall trees, often appropriating that of a large hawk, as a *Buteo*. Eggs said to be 3–6, not known to me to be more than 2 in number; colorless, subspherical, about 2.25 × 1.90 in size; duration of incubation said to be about three weeks. The young begin to hoot when about 4 months old. This owl preys upon birds and quadrupeds up to the size of domestic fowls and rabbits. It is habitually abroad in the daytime, apparently not at all inconvenienced by sunlight. Runs into the following varieties, which, however, are *not* as strictly geographical as the names would indicate:

463. **B. v. arc'ticus.** (Lat. *arcticus*, northern.) WHITE HORNED OWL. Very pale colored, frequently quite whitish, and not distantly resembling the snowy owl. (See Swainson's fig. in F. B. A., pl. 30.) Boreal and alpine North Am.; such specimens occasional in Northern U. S. in winter, and Rocky Mt. region.

464. **B. v. paci'ficus.** (Lat. *pacificus*, of the Pacific ocean.) DUSKY HORNED OWL. Very dark colored, chiefly blackish and grayish, with little or no tawny. Apparently a littoral phase, supposed to be more particularly developed on the Pacific coast; but the extreme of this style, in which the tawny is extinct, and which has been called *B. saturatus*, is from Labrador, where also occur the darkest specimens of Gyrfalcons.

FIG. 354. — Screech Owl, reduced. (From Dall.)

162 **SCOPS.** (Gr. σκώψ, Lat. *scops*, a kind of owl. Fig. 354.) LITTLE HORNED OWLS. SCREECH OWLS. Like a miniature *Bubo* in form (all our species under a foot long). Skull and ear-parts symmetrical; latter small, simply elliptical, with rudimentary operculum; facial disc moderately developed; plumicorns evident; nostrils at edge of the cere, which is not inflated, and shorter than the rest of the culmen. Wings rounded, but long, about twice the length of the short rounded tail, about to the end of which they fold; in our species the 4th and 5th primaries longest, the 1st quite short; 3 or 4 outer primaries sinuate or emarginate on inner webs. Tarsus feathered (in our species), but toes only partly bristly (in the *S. asio* group) or quite naked (as in *S. flammeola*). Plumage dichromatic in some cases; *i. e.*, some individuals of the same species normally mottled gray, while others are reddish, the two phases very distinct when fully developed, but shading insensibly into each other, and entirely independent of age, season, or sex. In normal plumage, a white or whitish scapular stripe; lower parts with lengthwise blotches or shaft-lines and crosswise bars or waves of blackish or dark color; upper parts with black or blackish shaft-lines on a finely-dappled brown or gray ground (more or less obliterated in the red phase); facial disc black-bordered nearly all around; wing-quills spotted or marbled on outer webs, barred on

inner webs. Tail with light and dark bars. A large and nearly cosmopolitan genus, especially rich in tropical species; but only two are known to inhabit N. Am., one of them running into several local races very difficult to characterize satisfactorily.

Analysis of Species and Varieties.

Toes bristly or partly feathered. Plumicorns conspicuous . . . . . *asio* 465
- Dichromatic; red phase bright rusty. Eastern.
  - Medium in size: wing usually between 6.00 and 7.00; tail about 3.50. Markings of under parts coarse, irregular, and blotchy, usually wanting on middle of belly; of upper parts fine but irregular, without nuchal collar. Eastern U. S. and Canada . . . . . *asio* 465
  - Small: wing usually 5.50–6.00; tail about 3.00. Markings as in *asio*, but rather heavier. Florida *floridanus* 469
  - Small: size of *floridanus*. Markings of under parts fine, regular, of upper parts coarse, but regular, with tendency to a nuchal collar. Texas . . . . . *maccalli* 468
- Dichromatic; red phase rusty-brown. Northwestern.
  - Large: wing usually over 7.00. In the gray phase like *asio*, but markings of under parts finer, more regular and continuous. Northwestern . . . . . *kennicotti* 466
- Dichromatism not known to occur. Western.
  - Medium: size of average *asio*. Markings of under parts thick, regular, continuous over the whole surface; of upper parts exactly as in *asio*. California . . . . . *bendirii* 466*a*
  - Medium: size of average *asio*. Markings of all parts very light, the gray pale, with much white, especially on wings and under parts . . . . . *maxwellæ* 467

Toes perfectly naked. Plumicorns short. Southwestern . . . . . *flammeola* 471

465. S. a/sio. (Lat. *asio*, a kind of horned owl.) LITTLE HORNED OWL. SCREECH OWL. MOTTLED OWL. RED OWL. Of medium size; length 8.00–10.00; extent about 22.00; wing 6.00–7.00, usually between these numbers; tail 3.25–3.50. *Gray or normal phase*, adult ♂ ♀: Upper parts brownish-gray in minutely dappled pattern of lighter and darker shades, everywhere finely but irregularly streaked with black or blackish shaft-lines, usually most evident on the crown. A conspicuous oblique scapular bar formed by the white or creamy outer webs of several scapulars, each usually touched with black at its end; a second similar bar on outer webs of several outer wing-coverts. Wing-quills dusky, the outer webs of the primaries with several distinct conspicuous white or buff spots; the inner webs of the primaries and both webs of the secondaries with numerous alternating lighter and darker bars; lining of wings mostly yellowish-white. Tail like the secondaries, but the light bars mostly ragged or dissipated in marbling. Facial disc set in a blackish frame nearly all around; mostly finely mottled, but the lores and chin usually whitish, immaculate. Taking white as the ground of the under parts, this is coarsely and irregularly blotched and streaked with thick shaft-lines giving off numberless finer curved or wavy cross-bars; the general aspect patchy; the markings usually wanting on the middle of the belly. Iris yellow; bill livid or slate-gray, pale horn-color at tip; claws blackish. From this stage the 'mottled owl' passes by insensible degrees, through wood-brown, hazel-brown, and tawny into the 'red owl.' — *Red or erythrismal phase:* Bright rust-red, sometimes even bronzed; most of the special markings dissipated or absorbed in the red, continuous and uniform above, showing only traces if any of the black shaft-stripes; below, black stripes and blotches usually preserved, and the red also mixed with much white. The dark rim of the disc, and white scapular stripes, are usually preserved. The two phases are distinct from the first feathering. Nestlings are covered with white down. The first feathering, in the normal phase, is almost everywhere closely and regularly barred or waved crosswise with dark gray and pale gray or whitish. Eastern U. S. and Canada, W. to the Rocky Mts., on the confines of its range shading into the several varieties noted beyond; resident, and on the whole the most abundant owl, breeding about buildings as well as in hollow trees or stumps, and feeding on small quadrupeds, as mice and shrews, small birds, and insects; nest a slight structure in the hollow selected for a resident; eggs 5 or 6, white, subspherical, 1.30 to 1.40 × 1.15 to 1.20.

466. S. a. kennicot'ti. (To Robert Kennicott.) KENNICOTT'S SCREECH OWL. The larger northern form. Length about 11.00; wing usually 7.00–7.50, but grading down in some cases

to 6.50; tail about 4.00. In the gray phase, very similar to *asio* proper, the upper parts being in fact indistinguishable, but the markings of the under parts finer, more regular and continuous over the whole surface; in the 'red' phase dusky umber-brown, quite unlike the bright rust-color of *asio*. This state was long supposed to be the only one, and characteristic of the bird; it occurs chiefly coastwise and far north, while the gray phase, only distinguishable from that of *asio* as above said, seems to be the rule in the U. S. In size, some New England specimens are fully up to the average of *kennicotti*. West and Northwest N. Am., from Idaho to Sitka.

466a. **S. a. bend'irii**. (To Capt. Chas. Bendire.) CALIFORNIA SCREECH OWL. No red phase known to occur. Size of *asio*, and extremely like it, differing chiefly in the finer, more numerous and continuous cross-bars of the under parts, which cross the middle of the belly as elsewhere; the shaft-stripes also appear less blotchy. It is thus quite like the gray phase of *kennicotti*, but smaller. The plumicorns are said to be shorter. Coast region of California, common. I have gone carefully over a series of *Scops*, and appreciate the points lately made by Mr. Brewster and Mr. Ridgway. If these fine shades are to be recognized by name, the present seems entitled to be named with the rest.

467. **S. a. maxwel'læ.** (To Mrs. M. A. Maxwell, of Boulder, Colorado, a noted huntress and taxidermist.) COLORADO SCREECH OWL. Size of *asio;* no red phase observed; but, on the contrary, the whole plumage very pale, almost as if bleached, the difference evident in nestlings even. Upper parts pale gray, with reduced black lines; lower whiter with reduced dark shaft-lines and cross-bars, the scapular bar very conspicuous; much white on wing-coverts; white spots on outer webs of several primaries running into continuous areas only indented with small dark spaces. Mountains of Colorado, and doubtless adjoining ones; an alpine form.

468. **S. a. maccal'li**. (To Col. Geo. A. McCall.) TEXAS SCREECH OWL. A small southern form; size of *floridanus;* gray and red phases, as in *asio* proper. Very similar to *asio;* in the gray phase, the markings of the under parts finer, firmer, more regular and continuous, the shaft-lines strict, not blotchy, the cross-lines sharp; the stripes of the upper parts coarse, but regular, and the nape with a tendency to present a light nuchal collar. Texas and southward, to Guatemala. (*S. maccalli* CASS., 1854, 1858; COUES, 1872; *S. asio* var. *enano* LAWR., RIDGW., Hist. N. A. B., iii, 1874, p. 48, but not *maccalli, ibid.*, p. 52.)

469. **S. a. florida'nus**. (Of Florida.) FLORIDA SCREECH OWL. A small southern form; wing 5.50–6.00; tail about 3.00. Coloration as in *asio;* red phase frequent if not the usual one; in its full development, the rusty makes quite firm broad cross-bars on the under parts, which is not the rule in *asio*, though very evident in specimens from Southern Illinois, for example, where the red is by far the most frequent plumage. Florida, and adjoining regions.

470. **S. trichop'sis?** (Gr. *θρίξ, τριχός, thrix, trichos*, hair, *ὄψις, opsis*, aspect.) An alleged species, or a subspecies of *asio*, with which I am unacquainted. Described as having the bars of the lower surface fine, nearer together than in *asio*, and much more uniformly distributed; the general aspect being paler than in *asio*, with much finer vermiculations (Ridgway). California, New Mexico, and southward. (*S. a. maccalli*, RIDGW., Hist. N. A. B., iii, 1874, p. 52; *S. trichopsis*, RIDGW., Pr. U. S. Nat. Mus., 1878, p. 114; but whether of WAGLER, 1832?)

471. **S. flamme'ola**. (Lat. *flammeola*, here signifying a little reddish thing.) FLAMMULATED SCREECH OWL. A small species, with much the general aspect of an ungrown *S. asio;* but the close feathering of the tarsus stops abruptly at the bases of the toes, which are naked, and the plumicorns are quite short. Length 6.50–7.00; wing 5.25–5.50; tail 2.75; tarsus 0.90; culmen, without cere, 0.35; middle toe, without claw, 0.55. Adult ♂ ♀: Facial disc, sometimes whole head, rusty-rufous, or light chestnut, speckled with black, on the top of the head also with white, tending to form a superciliary stripe. Ground of under parts white, but heavily overlaid with shaft-stripes or blotches of black giving off irregular cross-waves, on the breast tinged with rusty-rufous here and there; tarsi white, speckled with dusky. Upper parts minutely dappled with dark brown and hoary-gray, and with ragged dark shaft-stripes; a con-

spicuous whitish scapular bar, as in *S. asio*. Tail like back, but with numerous narrow and ragged cross-bars of pale rusty or whitish. Wing-quills 'bitten in' on outer webs with white or buff, conspicuously so on several primaries, their inner webs with regular but narrow, distant and weak bars, strengthening, however, toward the bases of the secondaries. Young birds, like those of *S. asio*, tend to a uniform cross-barring of the whole plumage, but especially of the under parts, with light and dark; the top of the head is finely vermiculated in this manner; the chestnut first appears on the ear-coverts and about the eyes; but in any color-variation this interesting little *Scops*, only about as large as a *Glaucidium*, is unmistakable.

163. **A'SIO.** (Lat. *asio*, a kind of horned owl.) Eared Owls. Marsh Owls. Skull and ear-parts more or less unsymmetrical; the conch of immense size, about as long as the skull is high, furnished with a movable operculum for its full length. Eyes centric in the perfectly developed facial disc. Plumicorns more or less developed. Nostrils at edge of the cere, which is somewhat inflated, and longer than the chord of culmen beyond it; bill rather weak. Wings about twice as long as tail, pointed, 2d primary usually longest, only 1 or 2 primaries emarginate on inner webs. Feet closely feathered to the ends of the toes. Of medium size; our species 12–16 inches long. Embracing numerous species, and nearly cosmopolitan. Our long-eared owl is decidedly different from that of Europe, *Asio otus*, but the short-eared has not been satisfactorily distinguished from the almost cosmopolitan *A. accipitrinus*.

Analysis of Species.

Plumicorns long, many-feathered (*Asio* proper) . . . . . *wilsonianus* 472
Plumicorns short, few-feathered (*Brachyotus*) . . . . . *accipitrinus* 473

472. **A. wilsonia'nus.** (To A. Wilson. Fig. 56.) American Long-eared Owl. Ear-tufts conspicuous, about as long as middle toe and claw, of 8–12 feathers. First primary only emarginate on inner web. Upper parts brownish-black, minutely mottled with grayish-white, and variegated with the tawny of basal portions of the feathers which comes to the surface here and there; the general effect dark, quite different from the tawny streaking of *A. otus* of Europe. Under parts confused blackish-brown, grayish-white and tawny; on the breast marbled in large pattern, for the rest with dusky shaft-lines throwing off dusky cross-bars (several on each feather) on a whitish ground, and the tawny bases of the feathers showing more or less; feet and crissum mostly immaculate, tawny or whitish. Quills blackish-brown, regularly barred with mottled gray, and towards their bases with tawny, which latter forms a conspicuous area on the outer webs of several primaries. Lining of wings tawny, separated by a dusky area from the similar bases of the inner webs of the primaries. Tail like the secondaries, dusky with gray marbled bars, and more or less tawny towards the base; but from below presenting quite light, with numerous firm narrow dusky bars. Facial disc mostly tawny, framed all around in a blackish border speckled with whitish, and more or less blackened about the eye; usually a whitish superciliary line; bristles at base of bill mixed whitish and blackish; plumbeous-blackish, basally tawny, edged on one side with whitish. Bill and claws blackish; iris yellow. Length 14.00–16.00; extent about 39.00; wing 11.00–12.00; tail 5.50–6.50; tarsus 1.25–1.50; chord of whole culmen about 1.00. Less variable than many owls, and always easy to recognize. N. Am. at large, common and generally distributed, resident; perfectly nocturnal, and thus screened from casual observation, even where it is numerous, but often surprised in the daytime in shady resorts, as thick bushes along streams, cañons, caves, etc. Nesting various, in a hollow tree or stump, rift of rock, on the ground, or in deserted nests of other birds, as hawks, crows, magpies, or even herons; usually constructed with little art, as when in a hollow or on the ground, sometimes better built in branches of a thick tree. Food small quadrupeds, birds, and insects. Eggs white, subspherical, 1.50 to 1.60 × 1.30 to 1.40.

473. **A. accipitri'nus.** (Lat. *accipitrinus*, hawk-like. Fig. 355.) Short-eared Owl. Marsh Owl. Ear-tufts inconspicuous, much shorter than middle toe and claw, few-feathered. First

and 2d primaries emarginate on inner webs. Above, completely variegated, chiefly in streaks, with fulvous or tawny, and dark brown; breast much the same, but other under parts paler ochrey, usually bleaching on the belly, which is sparsely but sharply streaked (never barred) with dark brown; feet pale tawny or whitish, usually immaculate; lining of wings interruptedly whitish. Wing-quills varied, mostly in large pattern, and tail pretty regularly barred (about 5 bars) with the two colors of the upper parts. Facial area white or nearly so, but with a large black eye-patch; the disc minutely speckled with fulvous and blackish, bordered with white internally and usually having a blackish patch behind the ear; radiating feathers of the operculum streaked with blackish and fulvous. Iris bright yellow; bill and claws dusky-bluish; the naked granular soles yellowish. The ear-opening of this species is extremely large, being two inches or more across the longest way. Length of a ♂ 14.50; extent 41.00; wing 12.00; tail 6.00; tarsus to end of middle claw 3.50; chord of culmen, cere included, 1.12; ♀ averaging larger than ♂. Inhabits N. Am. at large,

Fig. 355. — Short-eared Owl, reduced. (Sheppard del. Nichols sc.)

and most other parts of the world. It appears to be somewhat migratory with us, and is sometimes seen in considerable flocks, especially in marshy places, which are its favorite hunting-grounds for the small quadrupeds and other animals upon which it preys. It is a great destroyer of shrews and field-mice, deserving on this account to be protected in the interests of agriculture. The nest is commonly built on the ground, sometimes in an underground burrow, consisting of a little hay and feathers; the eggs are 4–7 in number, dull white, roundish, about 1.55 × 1.25. This owl breeds indifferently in any latitude, and is one of those frequently abroad in the daytime.

164. **STRIX.** (Gr. *στρίγξ*, *strigx*, Lat. *strix*, a screech-owl.) Gray Owls. Brown Owls. Wood Owls. Skull and ear-parts more or less unsymmetrical, the latter large, furnished with a moderate operculum scarcely reaching the whole length of the opening. Head very large, appearing as broad as the body, and perfectly smooth, there being no plumicorns: facial disc complete and of great extent, the comparatively small eyes centric in the radiating feathers. Nostril in edge of cere, which is shorter than rest of culmen. Bill yellow; iris yellow or black. Tail very long, $\frac{2}{3}$ to $\frac{3}{4}$ as long as the wings. Wings much rounded; 4 to 6 primaries sinuate on inner webs; 1st quite short. Feathering of feet variable; tarsus always feathered, but toes wholly or partly feathered, or naked. A large genus of 'earless' owls, chiefly of the northern hemisphere, of medium to very largest size. North America has at least three perfectly distinct species; the commonest one of these, *S. nebulosa*, represents the European tawny owl, *S. ăluco*.

Analysis of Species.

Under parts streaked on the breast, elsewhere barred. Iris yellow. Six quills sinuate.
Of immense size; length 2 feet or more; toes densely feathered. Northern . . . . . *cinerea* 474
Under parts barred on the breast, elsewhere streaked. Iris black. Five quills sinuate.
Of medium size: length about 1½ feet.
Toes fully feathered. Eastern . . . . . *nebulosa* 476
Toes mostly naked. Florida . . . . . *alleni* 477
Under parts barred everywhere. Iris black. Five quills sinuate.
Of medium size; toes fully feathered. Western . . . . . *occidentalis* 478

474. S. cine′rea. (Lat. *cinerea*, ashy.) Great Gray Owl. Spectral Owl. Feet completely feathered to the claws; bill and eyes yellow; 6 primaries cut on inner webs. Entire upper parts dark brown, mottled with grayish-white in confused and intricate pattern, reducible in general to dissipation of bars. Wings and tail similar, broken-barred with grayish-white marbling. Under parts of the same dark brown and pale gray, the pattern in streaks on the breast, in cross-bars on the belly and flanks, in spots on the feet. The great facial disc watered with dark brown and light gray in regular rings concentric with each eye, the outermost ring dark brown, and stronger than the rest, bounded below with a ragged white collar. Length 2 feet or more; extent about 5 feet; wing 16.00–18.00 inches; tail 11.00–12.50; culmen 1.00 without cere. An immense owl, one of the largest of all, inhabiting Arctic America, straying irregularly south into the U. S. in winter, even to New Jersey, Illinois, and California; said to be common from our northern border northward, and perhaps resident in Northern New England. Nest in trees, of sticks, mosses, and feathers; eggs usually 3 or 4, not equal-ended and rather small for the bird, 2.25 × 1.80. Like others of the genus it is a wood owl; while its prowess enables it to prey upon creatures up to the size of grouse and hares.

475. S. c. lappo′nica. (Lat. *lapponica*, of Lapland.) Lap Owl. Specimens from Alaska, lighter colored than ordinary, have been referred to the European rather than the American variety.

476. S. nebulo′sa. (Lat. *nebulosa*, clouded. Fig. 356.) Barred Owl. Hoot Owl. American Wood Owl. Toes fully feathered, nearly or quite to the claws, which are blackish; bill yellow; iris black. Of medium size in the genus: length 18.00–20.00; extent about 44.00; wing 12.50–13.50, rounded; tail 9.00–10.00, rounded. Markings of back and breast in cross-bars, of belly in lengthwise stripes. Above, umber-brown or liver-color, everywhere barred with white or tawny, or both; breast the same; on the belly the pattern changing abruptly to heavy dusky shaft-stripes on a white or tawny ground; crissum the same; feet speckled with dusky; wings and tail like the back or rather darker, regularly barred with gray, light brown or tawny, some of the bars usually making white spots at their ends, and the marking of the wing-coverts rather in spots than bars. Lining of wings tawny, with some dusky spotting. Facial disc set in a frame of black and white specks, with blackened eye-lids, and obscurely watered with lighter and darker colors in rings around the eye as a centre, the bristly feathers about the bill mixed black and white, or white at base, blackened terminally. A notably large and somewhat impressive owl of Eastern N. Am., common in woodland of the U. S., especially southerly; not known to range much north of the U. S., though occurring in parts of Canada, and not reported from the West, where apparently replaced by *S. occidentalis*. It is the commonest 'hooting' owl, the strange outbursts of midnight discord which one may hear about the farm-house or camp-fire proceeding oftener from this species than from the great horned owl; and it is strong enough to prey upon poultry, quail, rabbits and squirrels, as well as humbler game. Nest in a hollow tree, or a deserted hawk's or crow's nest; eggs laid early in spring, white, subspherical, about 2.00 × 1.75.

Fig. 356. — Barred Owl, reduced.

477. **S. n. alleni.** (To J. A. Allen.) FLORIDA BARRED OWL. Like *S. nebulosa* proper, but toes almost entirely naked. The feathering of the tarsus stops at the roots of the toes almost as abruptly as it does in *Scops flammeola*, in comparison with *S. asio*, though a slight strip of bristly feathers runs along the outside of the middle toe. The barring of the breast seems to be heavier, on an average. Florida; a local race.

478. **S. occidentalis.** (Lat. *occidentalis*, western.) WESTERN BARRED OWL. Toes feathered as in *S. nebulosa*. Decidedly smaller than that species, and otherwise readily distinguished. Ground-color of upper parts much the same, but the barring broken up into spotting, for the most part; on the back and wing-coverts resulting in irregular variegation, on the head making small round white spots. Wings, tail, and facial disk much as in *S. nebulosa*. Under parts quite different, the markings being in bars everywhere, with little difference in pattern between the belly and the breast. The latter is closely and regularly barred with brown and white, as in *S. nebulosa*, and if the barring is at all different on the belly, it is from separation of the white bars into pairs of spots, in any event very different in appearance from the firm lengthwise stripes of *S. nebulosa*. The difference between the two species in this regard is comparable to that between the long- and short-eared owls. The lining of the wings is fully spotted with dusky on a tawny ground. The general brown color of the bird is on the whole warmer than that of *S. nebulosa*. Length about 16.00; wing 12.00–13.00; tail 8.00–9.00. Western U. S., southerly; a very distinct species, apparently replacing the barred owl, common in parts of California, Arizona, and New Mexico. Egg 2.00 × 1.75, yellowish-white, granular.

165. **NYCTEA.** (Gr. *νυκτός, nukteus*, Lat. *nyeteus*, nocturnal.) SNOW OWLS. Much the same generic characters as *Bubo*, which see; but plumicorns rudimentary, and generally considered wanting; facial disc quite incomplete, and eyes not centric to it; bill nearly buried in the frontal feathers; feet densely clothed in long shaggy feathers which even hide the claws; four outer quills emarginate on inner webs; under tail-coverts reaching end of tail, which is rounded, and rather more than ½ as long as the wing. One circumpolar species of great size, and mostly white color; young covered with sooty down.

FIG. 357. — Snowy Owl, reduced. (From Tenney, after Audubon.)

479. **N. scandiaca.** (Lat. *scandiaca*, of Scandinavia. Fig. 357.) SNOWY OWL. Pure white, spotted and barred with brownish-black markings, wholly indeterminate in size and number; but entirely white specimens are very rare. There is often more blackish than white; and in the darkest birds, the markings tend to bar the plumage with rows of spots, such pattern specially evident on the wings and tail. A common average plumage is spotted all over the upper parts, broken-barred on the quills and tail-feathers, regularly barred on the under parts, and with white face and paws. The face, throat, and feet are usually whitest. Bill and claws black; iris yellow. Nearly or about two feet long; extent 4.50–5.00 feet; wing 16.00–18.00 inches; tail 9.00–10.00; culmen 1.10 without cere; tarsus 2.00; middle toe without claw 1.25. This remarkable owl, conspicuous in size and color, abounds in the boreal regions of both hemispheres, whence it comes southward irregularly in winter, sometimes raiding in large numbers. With us, it is of every winter occurrence in the Northern and Middle States, sometimes pushing its way even to the

Carolinas and Texas; there being no part of the U. S. where it may not appear at that season. It is far from being exclusively nocturnal, and hunts abroad in the day-time as readily as any hawk. It has never been ascertained to breed in the U. S., though it probably does so in Maine, as is certainly the case little further north. It is capable of enduring the rigors of Arctic winters. The nest is usually upon the ground or rocks; the eggs are 5 to 10, laid at intervals (as is the case with various other owls), so that the nest may contain fresh and incubated eggs and young birds at once; they are equal-ended, about 2.50 × 1.90. The bird preys upon grouse, ptarmigan, hares, and smaller game, especially the field-mice and lemmings which swarm in the Arctic regions.

166. SURNIA. (Etym. of *Surnia* or *Syrnium* unknown.) Hawk Owls. Skull and ear-parts much as in *Bubo* or *Nyctea;* latter non-operculate, the opening of small size; facial disc very little developed, and eyes not centric to it; no plumicorns. Wings folding far short of end of tail; third primary longest; first 4 emarginate on inner webs. Tail remarkably long, little shorter than the wing, much graduated, with lanceolate feathers. Feet thickly and completely feathered to the claws; tarsus scarcely or not longer than middle toe. Of medium size, with a peculiarly neat and dressy appearance, for an owl, the whole plumage being more strict than in other members of this family. There is but one species, common to northern portions of both hemispheres, as hawk-like in habits as in mien, though unmistakably an owl.

480. S. funerea. (Lat. *funerea*, funereal. Fig. 358.) American Hawk Owl. Day Owl. Bill and eyes yellow; claws brownish-black. Upper parts bistre-brown, darkest and almost blackish on the head, where profusely spotted with small round white marks, to which succeeds a nuchal interval less spotted or free from spots, then an area of larger and lengthened spots; scapulars profusely spotted with white in large pattern, forming a scapular bar as in *Scops;* back and wing-coverts more or less spotted with white also; primaries and secondaries with white spots in pairs on opposite edges of the feathers. Tail broken-barred with white or pale gray, usually narrowly and distinctly, on one or both webs, and tipped with the same; but there is great individual variation in this respect, as may also be said of the amount and character of the spotting of the whole upper parts. Under parts from the breast backward, including the crissum, closely and regularly cross-barred with rich reddish-brown, or even reddish-black, upon a white ground, the alternating bars of color usually of about equal widths — if anything, the white the broadest. The lining of the wings shares the same character, but is more spotty; the paws are mottled with brown and whitish, in different pattern. On the breast the regular barring gives way, the tendency being to form a dark pectoral band on a white or spotted ground, but this disposition is seldom perfected. Facial disc mostly whitish, bounded by a conspicuous blackish crescent behind the ear. When the dark nuchal collar is perfected, a second bar curves down behind the first on

Fig. 358. — Hawk Owl, reduced. (Sheppard del. Nichols sc.)

the side of the neck, separated by a whitish interval; the edges of the eyelids, many of the loral bristles, a line just in front of the eye, and a chin-spot, are black or dusky; the lower part of the disc below the ears has also dusky streaks. The exposed part of the bill is bright yellow, as said, but most of that hidden by the bristles is of a dark livid color. However variable in detail, the markings of this species are unmistakable; those about the head are better defined than in most owls, and quite peculiar. Length 15.00; extent 33.00; wing about 9.00; tail about 7.00; tarsus, or middle toe without claw, 1.00 or less; culmen without cere 0.75. A handsome and spirited owl, abundant in northern portions of N. Am., S. into northern U. S. in winter, frequently and regularly; apparently resident in Maine. Like the snowy owl, it endures the rigors of Arctic winters. Nest usually in trees, sometimes on rocks or stumps, of sticks, mosses, grasses, and feathers; eggs 4–7, April, May, about 1.55 × 1.25, whitish. The food of this species seems to be chiefly field-mice and other small rodents, hawked for in broad daylight, this owl being apparently the least nocturnal of its tribe.

481. S. f. u'lula. (Lat. *ulula*, a screech owl.) EUROPEAN HAWK OWL. Lighter-colored specimens from Alaska have been considered to represent this variety, just as darker-colored ones, from the British Islands, have been referred to the preceding variety.

167. NYC'TALA. (Gr. *νύκταλος*, *nuktalos*, sleepy.) SAW-WHET OWLS. Skull and ear-parts highly unsymmetrical, the latter of great size, and fully operculate. Head very large (as in *Strix*), without plumicorns; facial disc complete, with centric eye. Nostril at edge of the cere, which is inflated or not. Tail from ½ to ⅔ as long as the wing, rounded. Third and 4th primaries longest; 1st quite short; 2 or 3 emarginate on inner webs. Feet thickly and closely feathered to the claws. In this interesting genus the ear-parts are of great size, and reach the extreme of asymmetry, the whole skull seeming misshapen. Three species are known, all of small size; one of circumpolar distribution, one peculiar to N. Am., the third of unknown habitat, probably American. They are notable for the unusual degree of difference between old and young; and our species are readily distinguished by stronger characters than are ordinarily found between congeneric owls. The adults are umber or chocolate-brown above, spotted with white, below white, striped with brown; the young more uniform. Eyes yellow; bill black or yellow.

Analysis of Species.

Larger: wing about 7.00; tail 4.50. Bill yellow; cere not tumid; nostrils presenting laterally, and obliquely oval. Arctic . . . . . *richardsoni* 482

Smaller: wing 5.50; tail 2.67. Bill black; cere tumid; nostrils presenting anteriorly, and about circular. U. S. . . . . *acadica* 483

482. N. teng'malmi rich'ardsoni. (To P. G. Tengmalm, and J. Richardson.) ARCTIC AMERICAN SAW-WHET OWL. *Adult:* Upper parts, including wings and tail, uniform chocolate-brown, spotted with white; on the top of the head the spots small and profuse, on the nape larger and blended into a nuchal collar, on the back and wing-coverts large and sparse, but tending to form a scapular bar, on the wing-quills and tail-feathers in pairs, at the opposite edges of the webs, on the inner webs larger, more like bars, and more or less run together, especially on the inner secondaries. Under parts white, thickly and confusedly streaked lengthwise with the color of the back. Facial disc mostly white, but with blackish eyelids and loral spot, set in a frame of dark brown speckled with white. The general tone of the brown of this species is oftenest ruddy, nearly as in *N. acadica*, but sometimes dark and pure. *Young* not seen by me; said to differ from the adult much as *N. acadica* does. Length 11.00–12.00; extent 24.00; wing 7.00; tail 4.50; tarsus 1.00; middle toe without claw 0.67; culmen without cere 0.60. Said to be distinguished from the European conspecies (fig. 359) by its darker coloration, ochrey feet spotted with brown instead of being nearly immaculate white, and more heavily streaked under tail-coverts. This fine species inhabits the Arctic regions, being seldom seen in the U. S., where only known in winter and not further south than New England, Wisconsin, Northern Ohio, and Oregon; though it is probably resident in Northern Maine, like the snowy

and hawk owls. The nest is said to be built in a tree; the eggs are variously stated to be from 2 to 6 in number; size 1.25 × 1.05.

483. N. aca'dica. (Lat. *acadica*, of Acadia.) ACADIAN OWL. SAW-WHET OWL. *Adult:* Upper parts, including wings and tail, very similar to those of the last species, but the ground usually a ruddier brown, the spotting less extensive, the marks on the top of the head pencilled in delicate shaft-lines instead of round spots, those of the wings and tail exactly as in *A. richardsoni*. Under parts white, diffusely streaked or dappled with a peculiar light brown, almost pinkish-brown. Feet immaculate whitish, tinged with buff. Facial disc mostly white, but blackened immediately about the eye and on the loral bristles, and pencilled with dusky on the auriculars; set in a frame of the color of the back, touched with white points behind the

FIG. 359. — Upper, Tengmalm's European Saw-whet Owl, very near No. 482. Lower European Sparrow Owl, resembling No. 484. Both ⅓ nat. size. (From Brehm.)

ear; this frame distinct on the throat where it separates the white of the disc from a white jugular collar, before the pectoral streaks begin. Bill black; claws dark; eyes yellow. *Young* quite different (*N. albifrons*): Above, ruddy chocolate-brown, without any spots; wings and tail more fuscous brown, marked substantially as in the adults. Below, the color of the back extending over all the fore parts, the rest being brownish-yellow; no streaks whatever. Facial disc sooty-brown, with whitish eye-brow, and some white touches on the rim behind the ear curving forward to the chin. Bill black, as before. Length 7.50–8.00; extent 17.00–18.00; wing 5.25–5.75; tail 2.60–2.90; tarsus 0.75; bill without cere 0.50; middle toe without claw 0.60. This curious little owl, the most diminutive species found in Eastern N Am., inhabits the U. S. from Atlantic to Pacific, and goes somewhat further North into British America, and also S. into Mexico. Though apparently common and generally distributed, it is

not very well known, as it is shy and retiring, and quite nocturnal in habits. It is chiefly noted for its shrill harsh notes, which, being likened to filing a saw, have occasioned its name. The nest is usually made in the hollow of a tree or stump, in April; the eggs are 3–6 in number, white, nearly globular, about 1.00 × 0.87.

168. **GLAUCI'DIUM**. (Gr. dimin. of γλαύξ, *glaux*, an owl.) GNOME OWLS. SPARROW OWLS. PYGMY OWLS. Size very small. Head perfectly smooth; no plumicorns; ear-parts small, non-operculate; facial disc very incomplete, the eye not centric. Nostril circular, opening *in* the tumid cere; bill robust. Tarsus fully and closely feathered, but toes only bristly for the most part. Wings short and much rounded, the 4th primary longest, the 1st quite short, the 3 outer ones emarginate, and next one or two sinuate. Tail long, about ¾ as long as the wing, even or nearly so. Claws strong, much curved. A large genus of very small owls, mostly of tropical countries. The numerous species, chiefly of warm parts of America, are in dire confusion, but the only two known to inhabit N. Am. are well determined. The plumage of many or most species is dichromatic, as in *Scops*, there being a red and a gray phase independently of age, season, or sex; but the red is not known to occur in our *G. gnoma*. The upper parts are marked with spots or lines; bars, or rows of spots, cross the wings and tail; the under parts are streaked; there is a cervical collar. Notwithstanding their slight stature, the gnome owls are bold and predaceous, sometimes attacking birds quite as large as themselves. They are not specially nocturnal. The eggs are laid in holes in trees, and are not peculiar in character.

Analysis of Species.

Markings of upper parts in dots and round spots. Tail dark brown, with rows of white spots . . *gnoma* 484
Markings of upper parts in sharp lines. Tail reddish, with dark brown bars . . . . . *ferrugineum* 485

484. **G. gno'ma**. (Lat. *gnoma*, a spirit of the mines.) CALIFORNIAN GNOME OWL. ♂ ♀, adult: Tail concolor with the back, and markings of the upper parts, as well as those crossing the wings and tail, in the form of dots or round spots, not lines or bars. Upper parts one shade of dark brown, everywhere dotted with small circular spots of white; a collar of mixed blackish-brown and white around the back of the neck; breast with a band of mottled brown, separating the white throat from the white of the rest of the under parts, which have irregular lengthwise streaks of reddish-brown. Wings and tail dusky-brown, the feathers marked on both webs with rows of round white spots, largest on the inner; under wing-coverts white, crossed obliquely by a blackish bar. Bill, cere, and feet dull greenish-yellow; soles chrome yellow; claws black; iris bright yellow; mouth livid flesh-color. Length of ♂ 7.00 or a little less; extent 14.50; wing 3.75; tail 3.00. Length of ♀ 7.50; extent 15.50, etc. In the ♀ the upper parts are rather lighter, with fewer larger spots, and a nearly obsolete nuchal collar; but both sexes vary in the tint of the upper parts, which ranges from pure deep brown to pale grayish, almost olivaceous, brown, probably according to age and season, the newer feathers being darker than they are when old and worn. The condition of erythrism, so well known in the next species, has not been observed in the present one, which is closely related to the sparrow owl of Europe (*G. passerinum*, fig. 359). Rocky Mts. to the Pacific, U. S. and southward, common in wooded regions; an interesting little owl, crepuscular and rather diurnal than strictly nocturnal, preying chiefly upon insects, but also upon birds and quadrupeds sometimes about as large as itself.

485. **G. ferrugi'neum**. (Lat. *ferrugineum*, rusty-red.) FERRUGINEOUS GNOME OWL. ♂ ♀, adult, *normal plumage:* Tail entirely ferrugineous, or light chestnut-red, crossed with 7 to 9 bars of blackish-brown, — of the same width as the rufous interspaces, and both sets of markings quite regular. (These tail-marks distinguish the species in any plumage from *G. gnoma*.) Entire top of the head, above the superciliary ridges, and sides of the head behind the auriculars, olivaceous-brown, streaked with small, distinct lines of white or fulvous-whitish; these markings being on the forehead and most of the crown like pin-scratches in their sharpness, and though a little less so behind the ears, everywhere retaining their narrow linear character. (In

G. gnoma, the head-markings are dots and spots, not lines.) Back like the head, olivaceous-brown, but without markings, except on the scapulars, most of which feathers have a large round white spot on the outer web near the end, and more or fewer pairs of fulvous spots on both webs. Color of back and head divided by an obvious cervical collar, consisting of a series of diffuse whitish, and another of fulvous, spots, separated by a nearly continuous line of black. Upper tail-coverts usually more or less rufescent, approximating to the color of the tail. Remiges olivaceous-fuscous, like the back, the primaries imperfectly and indistinctly, the secondaries completely and decidedly, cross-barred with numerous rufescent bands, narrower than the dark intervals; besides which markings some of the primaries have an incompleted series of small whitish or very pale fulvous spots along the outer edge, and all have large and deep indentations of white or whitish along the inner web, increasing in size from the ends toward the bases of all the feathers, and also on individual feathers from the outer primaries to the inner secondaries, on which last they reach quite across the inner webs. Lining of wings white, with an oblique dark bar, and another curved dark bar, the latter across the ends of the under coverts. Under parts white, heavily streaked along the sides with the color of the back; this color extending quite across the breast, where, however, the feathers have dilated shaft-lines of whitish; chin and throat white, divided into two areas by a blackish or dark gular collar, which curves across from one post-auricular region to the other. The markings all diffuse. Auriculars dark, sharply scratched with white shaft-lines, bounded below by pure white. Eyebrows white, pretty definitely bounded above by the color of the crown. Region immediately about the bill whitish, but mixed with the long, heavy, black bristles that project far beyond the bill, which latter is greenish at base, growing dull yellowish at the end; sparsely-haired toes somewhat like the bill; claws brownish-black; iris lemon-yellow. Length of ♂ about 6.50; extent 14.50; wing 3.50; tail 2.50; tarsus 0.75; middle toe without claw about the same, its claw 0.40. ♀ larger: length 7.00 or more; wing 4.00; tail nearly 3.00. *Red phase:* Entire upper parts deep rufous-red, with the lighter markings of the head, etc., obsolete or obliterated; tail the same, with dark bars scarcely traceable. Dark cervical collar, however, conspicuous. White of under parts tinged with yellowish or fulvous; the markings of the under parts similar in color to the ground of the upper parts, but duller and paler; tibiæ rufous, without markings. Gular collar blackish. Various intermediate stages have been observed, and the species is to be found in every degree of transition, from the slightest departure from the normal state to the completely erythritic condition. These color-conditions are common to both sexes. In extreme cases, the rufous becomes intense and almost uniform, a light rufous replacing even the white of the under parts, and there being no traces left of bars on the wings or tail. Texas to Arizona and Southern California, and southward.

169. **MICRATHE'NE.** (Gr. *μικρός, mikros*, small; *Ἀθήνη*, Athene, goddess of wisdom, to whom the owl was sacred.) Elf Owls. Related to *Glaucidium;* of very diminutive size, including the smallest known species of owl, and one of the least of all raptorial birds. Head perfectly smooth; no plumicorns; ear-parts small, non-operculate; facial disc incomplete, with eye not centric. Nostril circular, opening in the tumid cere. Tarsi scarcely feathered below the suffrago, being almost entirely naked and bristly, like the toes; this is as in *Speotyto*, though other characters are quite different. Claws remarkably small and weak; middle toe and claw about as long as the tarsus; outer claw reaching a little beyond base of middle claw; inner intermediate between middle and outer. Wings very long, rather more than $\frac{2}{3}$ the total length of the bird, but much rounded, the 1st primary only $\frac{2}{3}$ as long as the longest one; 3d and 4th longest, 5th but little shorter, 2d about equal to 6th; the outer four sinuate on inner webs. Tail of moderate length, $\frac{1}{2}$ as long as the wing, the feathers not graduated, and broad to their very tips. Bill small and weak, compressed at base, where hidden in dense antrorse bristly feathers; culmen and gonys only moderately convex; lower mandible obsoletely notched. One species known.

486. M. whit'neyi. (To Prof. J. D. Whitney.) ELF OWL. ♂, adult: Above, light umber-brown, thickly marked with irregular angular pale brownish dots, one on every feather, and minutely undulated with lighter and darker color. A concealed white cervical collar, this color occupying the middle of the feathers, which are brown at their ends and plumbeous at base. A white scapular stripe, the outer webs of the scapulars being almost entirely of this color. Wings like the back; lesser coverts with two pale brownish spots on each feather; middle and greater coverts boldly spotted with white at the end of the outer web of each feather, and with pale brown spots near the end. Quills with 3 to 6 pale brown spots on each web, forming broken bars, mostly passing to white on the edge of the feathers, those on a few intermediate primaries almost white. Tail-feathers like the wing-quills, with 5 broken bars and one terminal, of pale brownish whitening on the inner webs. Lining of wings white, interrupted with dark brown. Face and region about eye white, below it barred with light and dark brown; bristles at base of bill black on terminal half. Chin and throat white, forming a broad mark from side to side. General color of under parts whitish, the breast blotched and imperfectly barred with brown, forming toward the abdomen large patches, the sides more grayish, the flanks plumbeous, tibiæ narrowly barred with light brown and dusky. Tarsal bristles whitish; those of the toes yellowish; bill pale greenish; iris bright yellow. Length 5.75–6.25; extent 14.25–15.25; wing 4.25–4.50; tail 2.00–2.25; tarsus 0.80–0.90. Arizona and southward; a very curious little owl, not yet well known, few specimens having been secured. The general habits, nesting, and food, appear to be similar to those of the gnome owls.

170. SPEOTYTO. (Gr. *σπέος, speos*, a cave; *τυτώ, tuto*, a kind of owl.) BURROWING OWLS. Of medium and rather small size. Head smooth; no plumicorns; ear-parts small, non-operculate; facial disc incomplete. Nostril opening in the tumid cere. Wings of moderate length; 2d to 4th quills longest; 1st about equal to 5th; two or three sinuate on inner webs near the end. Tail very short, only about half as long as the wing, even or scarcely rounded. Tarsi extremely long, about twice as long as the middle toe without its claw, very scant-feathered in front, bare behind; toes bristly. The long slim legs are quite peculiar (fig. 360). A genus confined to America, where there are several varieties of apparently a single species, of diurnal and terrestrial habits, noted for inhabiting underground burrows.

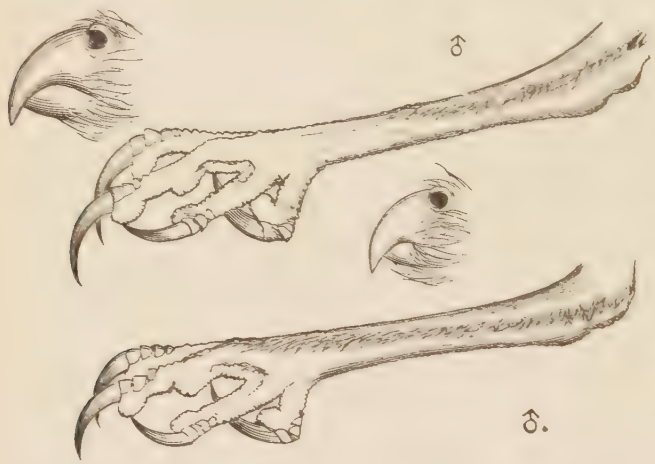


FIG. 360. — Bills and feet of *Speotyto*, nat. size. Lower, *S. hypogæa*; upper, *S. floridana*. (Ad nat. del. R. R.)

487. S. cunicula'ria hypogæ'a. (Lat. *cunicularia*, a burrower; Gr. *ὑπόγειος, hupogeios*, underground. Fig. 361.) Adult ♂ ♀: Above, dull grayish-brown, profusely spotted with whitish; the markings mostly rounded and paired on each feather, but anteriorly lengthened. Quills with 4 to 6 whitish bars, entire or broken into cross-rows of spots; tail-feathers similarly marked. There is much individual variation in the tone of the ground-color, and size and number of the spots, which may also be rather ochrey than whitish. Superciliary line, chin, and throat, white, the two latter separated by a dark brown jugular collar; auriculars brown; facial bristles black-

shafted. Under parts white or pale ochrey, the breast, belly, and sides barred with transverse spots of brown, in a pretty regular manner; legs and under tail-coverts unmarked. Lining of wings tawny-white, dusky-spotted on the primary coverts. Sexes indistinguishable in size or color: length 9.50; extent 23.00; wing 6.50–7.00; tail 3.00–3.25; tarsus 1.50–1.75; middle toe without claw 0.80; chord of culmen without cere 0.50–0.60. Young differ in much less spotting, or even uniformity, of the body above, and whitish under parts, excepting the jugular collar; wing- and tail-coverts largely white. A remarkable owl, abounding in suitable places in Western N. Am., from the Plains to the Pacific, in the treeless regions inhabited by the "prairie dogs," (*Cynomys ludovicianus* and *C. gunnisoni*) and other burrowing rodents, especially *Spermophilus richardsoni* in the north, and *S. beecheyi* in California. I have found colonies in Kansas, Nebraska, Wyoming, Dakota, Montana N. to 49°, Colorado, New Mexico and California, in all cases occupying the deserted burrows of the quadrupeds, not living in common with them as usually supposed. They also occupy the holes made by badgers and foxes. The eggs may be laid even 6 or 8 feet from the entrance of the burrow; they appear to vary in number up to 10; are white, subspherical, 1.30 × 1.10. The species has exceptionally occurred in Massachusetts. Its food is chiefly insects and small reptiles, birds and quadrupeds being apparently rarely taken. Wherever found, the species is resident, being able to endure extremely cold weather.

FIG. 361.—Burrowing Owl, reduced. (Sheppard del. Nichols sc.)

488. S. c. florid'ana. (Of Florida. Fig. 360.) FLORIDA BURROWING OWL. Like the last; rather smaller; wing 6.00–6.50; tail scarcely 3.00; shanks more extensively denuded, only feathered about half way down in front; feet and bill relatively longer. Upper parts darker, rather bistre-brown, more profusely and confusedly spotted with smaller and whiter marks; under parts more heavily and regularly barred with darker brown. Florida, an isolated local race, colonies of which are common in some places.

7. SUBORDER ACCIPITRES: DIURNAL BIRDS OF PREY.

This large group, comprising the large majority of the order *Raptores*, may be most readily defined by exclusion of the particular characters of the other suborders. There is nothing of the grallatorial analogy shown by the singular *Gypogeranides*. The nostrils are not completely pervious, nor is the hallux elevated, as in *Cathartides;* while other peculiarities of the American vultures are wanting. Comparing *Accipitres* with *Striges*, we miss the peculiar physiognomy of owls, the eyes looking laterally as in ordinary birds, and the facial disc being absent (rudimentary in *Circinæ*); aftershafts are usually present, and the outer toe is not versatile nor shorter than the inner one (exc. *Pandionidæ*). The external ears are moderate and non-operculate. The eye is usually sunken beneath a much projecting superciliary shield, conferring a decided and threatening gaze. The bill shows the raptorial type perfectly, and is always provided with a cere *in* which (not at its edge as in most owls) the nostrils open; the

cutting edges are usually lobed, or toothed (see any figs.). The lores, with occasional exceptions, due to nakedness or dense soft featherings, are scantily clothed with radiating bristly feathers, which, however, do not form, as usual in owls, a dense appressed ruff hiding the base of the bill. Wings of 10 primaries, and tail of 12 rectrices (with rare exceptions); both extremely variable in shape and relative and absolute lengths. The feet are usually strong and efficient instruments of prehension and weapons of offence or defence, with widely separable

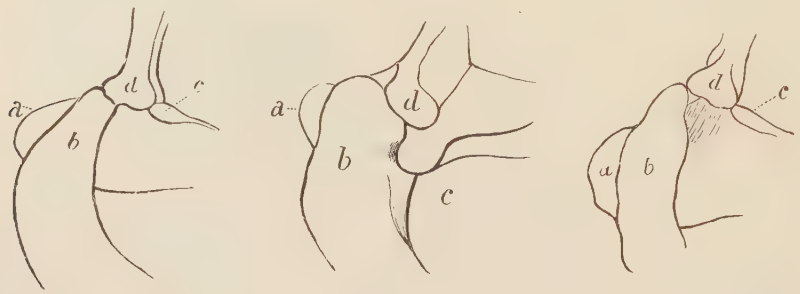


FIG. 362.—Shoulder-joint of *Accipitres;* after Ridgway. *a*, anterior end of coracoid; *b*, upper end of clavicle; *c*, scapular process of coracoid, reaching *b* in the middle fig. (*Falco peregrinus*), but not in the left-hand fig. (*Buteo borealis*), nor in the right hand fig. (*Pandion haliaëtus*); *d*, lower end of scapula. The figs nat. size, left side, viewed from opposite side.

and strongly contractile toes, cleft to the base or there only united by small movable webs, and generally scabrous underneath with wart-like pads or tylari to prevent slipping, as shown in fig. 46. The claws are developed into large sharp curved talons. The tarsal envelope (podotheca) varies; sometimes the whole tarsus is feathered, and it is usually so in part; the horny covering takes the form of scutella, or reticulations, or rugous granulations, and is occasionally fused. The capacious gullet dilates into a crop; the gizzard is moderately muscular; the cœca are extremely small. The oil-gland is tufted. The syrinx has one pair of intrinsic muscles. The ambiens and femoro-caudal muscles are present; the accessory femoro-caudal, semitendinosus and its accessory are absent. There are good osteological characters: The phalanges of the hind toe are more than half as long as those of the outer toe; the basal joint of the middle or outer toe is longer than the next one. There are no basipterygoid processes. The sternum is manubriated, and when not entire behind is single-notched or fenestrate on each side (doubly so in most owls). Huxley has called attention to a character of the shoulder-girdle, afterward well elaborated by Mr. Ridgway (fig. 362): In certain genera, as *Falco*, *Micrastur*, *Herpetotheres*, and in the *Polyborinæ*, the scapular process of the coracoid, fig. 362, *c*, is prolonged beneath the scapula, *d*, to meet the clavicle, *b;* which is not the case in other groups of genera of the *Falconidæ*, nor in *Pandionidæ*. This distinction has been made the basis of a primary division of the diurnal *Accipitres* into two subfamilies, *Falconinæ* and *Buteoninæ*, the former including *Polyborus* and its allies, the latter including *Pandion;* but some modification of this scheme is advisable, I think. It seems to me that the primary division should be made as on p. 498, by excluding *Pandionidæ* as a family distinct from *Falconidæ* proper, on the ground of its many peculiarities. This being done, the character of the shoulder-joint may properly be considered in dividing the *Falconidæ* into subfamilies. I am perfectly willing to approximate *Polyborus* to *Falco* on this technical ground, notwithstanding the great outward dissimilarity of these two forms; but it is unlikely that ornithologists will allow the construction of the shoulder-joint to outweigh all other characters combined.

Diurnal Birds of Prey abound in all parts of the world, holding the relation to the rest of their class that the carnivorous beasts do to other mammals. With many exceptions, the sexes are alike in color, but the female is almost invariably larger than the male. The changes of

plumage with age are great, and render the determination of the species perplexing — the more so since purely individual, and somewhat climatic, color-variations, and such special conditions as melanism, are very frequent. The modes of nesting are various; the eggs as a rule are blotched, and not so nearly spherical as those of owls. The food is exclusively of an animal nature, though endlessly varied; the refuse of the stomach is ejected in a ball by the mouth. The voice is loud and harsh. As a rule, the birds of prey are not strictly migratory, though many of them change their abode with much regularity. Their mode of life renders them usually non-gregarious, excepting, however, the vultures and vulture-like hawks, which congregate where carrion is plenty, quite like the American *Cathartides*. There are upwards of 300 species or good geographical races, justly referable to about 50 full genera, and divisible into two families — *Falconidæ* and *Pandionidæ*.

31. Family FALCONIDÆ: Vultures, Falcons, Hawks, Eagles, etc.

FIG. 363. — The Vulture's banquet: illustrating subfamily *Vulturinæ* of family *Falconidæ*, not represented in America. (From Michelet.)

Characters as above, exclusive of those marking the fish-hawks, *Pandionidæ*, beyond. No unexceptionable division of the family having been proposed, and the subfamilies being still at issue, it may be best not to materially modify the arrangement presented in the earlier edition of this work, further than to separate *Pandionidæ* from *Falconidæ* proper.

The *Old World Vultures* form a group standing somewhat apart from the rest in many points of superficial structure and habits, though so closely correspondent with ordinary *Falconidæ*, and especially with *Buteoninæ*, in all essential respects, that they can form at most a subfamily *Vulturinæ* (fig. 363.) They have nothing to do with the *American* Vultures (suborder *Cathartides*), with which they have been wrongly united in a family *Vulturidæ*. They are a small group of some six genera and about twelve species, of which the most decidedly raptorial is the bearded griffin, *Gypaëtus barbatus;* other characteristically "vulturine" forms being *Vultur monachus*, *Otogyps auricularis*, *Gyps fulvus*, *Neophron percnopterus*, and *Gypohierax angolensis*.

The South American genera, *Micrastur* and *Herpetotheres*, are each described as being so peculiar as to form a group of supergeneric value, comparable with those termed subfamilies in the present work. Their relationships are with *Falconinæ*. (Ridgway.)

The North American *Falconidæ* with which we have here to do fall in several groups, which I shall call subfamilies, without insisting upon their taxonomic rank, or raising the question whether the family at large is divisible in this manner. These groups are six in number: 1. *Circinæ*, harriers; 2. *Milvinæ*, kites; 3. *Accipitrinæ*, hawks; 4. *Falconinæ*,

falcons; 5. *Polyborinæ*, caracaras; 6. *Buteoninæ*, buzzards and eagles. If it be urged that these groups grade into one another, it may be replied that most large groups of like grade in ornithology do the same; and that 'typical' or central genera of each of them offer practical distinctions which have been recognized from time out of mind, in popular opinion and vernacular language. In my recent revision of the North American *Falconidæ*, made to check and amplify the descriptions in this work, an interesting relation between the shape of the wings and their pattern of coloration presented itself. (a) If we take a 'noble' falcon, such as a peregrine or a lanner, we find a strong, yet sharp wing, with the second primary longest, supported nearly to the end by the first and third; the nicking of the quills confined to a few, if occurring on more than one, and situated near the tip. Such a wing is as potent in its feathers as in the construction of its shoulder-joint, and indicates the acme of raptorial power in its possessor, a falcon being able to dash down upon its quarry with almost incredible velocity and violence. The markings of a falcon's wing are no less characteristic, consisting of clean-cut, distinct *spots* of light color on both webs of the primaries and secondaries, throughout their whole extent, or almost so. (b) Any true 'hawk,' as an *Astur* or *Accipiter*, has a rounded concavo-convex wing, conferring a rapid, almost whirring, flight, like that of a partridge at full speed; and such a bird captures its prey by chasing after it with wonderful impetuosity, but not at a single plunge like a falcon. Such a wing has more primaries cut, farther from their ends, and the markings are pretty regular and distinct *bars*. (c) Any 'buzzard,' as a *Buteo*, a heavy and comparatively slow or even lumbering bird in flight, taking its prey by surprise and merely dropping on it without special address, has many or most of the primaries cut, far from their ends, and the tendency of the markings is to fuse and blend in large irregular masses of color, the sharp markings of *Falco* or *Accipiter* being thus dissipated. Of course there are exceptions, as well as every possible gradation, in the case; but if one will compare the wing of *Circus* or *Archibuteo* with that of *Accipiter* and *Falco*, he cannot fail to perceive the point I raise. The tail is in somewhat like case. In the most noble birds of prey it is very stiff and strong, with almost lanceolate feathers, sharply spotted as a rule; in a hawk, longer and weaker, still regularly barred; in a buzzard *generally* (there are marked exceptions) of medium length and strength, with the markings tending to merge in large areas of color, just as those of the wings do.

It may be remarked further, without special reference to what has preceded, that in large and difficult genera, as *Buteo* for example, the best specific characters may be afforded by the markings of the tail. These are usually quite different in young and old birds; but are among a hawk's most specific credentials, after the mature plumage is assumed, even when the rest of the plumage varies greatly, or is subject to melanism, erythrism, etc. In fine, many hawks are best known by their tails. Melanism in frequent in *Falconidæ*; erythrism is not (just the reverse of the case of *Strigidæ*). The further generalization may be made, that the coloration of the under parts of *Falconidæ* is more distinctive of species than that of the upper parts; and that when these parts are barred crosswise in the adult they are streaked lengthwise in the young. Sexual differences are rather in size than in color, such a case as that of *Circus* being exceptional.

Analysis of Subfamilies.

Scapular process of coracoid reaching clavicle.
- Upper mandible toothed, lower mandible notched . . . . . FALCONINÆ
- Mandibles without tooth or notch . . . . . POLYBORINÆ

Scapular process of coracoid not reaching clavicle.
- Face with a ruff somewhat as in owls . . . . . CIRCINÆ
- Face without ruff.
  - Tarsus approximately equal to tibia in length; rounded wings little longer than tail ACCIPITRINÆ
  - Tarsus decidedly shorter than tibia.
    - Tail forked, or much shorter than the long pointed wings . . . . . MILVINÆ
    - Tail not forked, moderately shorter than the obtuse wings . . . . . BUTEONINÆ

42. Subfamily CIRCINÆ: Harriers.

FIG. 364. — Ear-parts of *Circus*. (After Macgillivray.)

Face surrounded with an incomplete ruff (as in most owls); orifice of ear about as large as the eye, and in some cases at least with a decided conch (fig. 364). Bill rather weak, not toothed or notched. Legs lengthened, the tarsus approximately equalling the tibia in length (as in *Accipitrinæ*). Wings and tail lengthened. Form light and lithe; plumage loose; general organization of the buteonine rather than of the falconine division of the family. Thus, the scapular process of the coracoid is not produced to the clavicle; there is no median ridge on the palate anteriorly; the septum nasi is less complete than in *Falco*, and the nostrils are not circular with a central tubercle. The harriers constitute a small group, of the single genus *Circus* and its subdivisions (to which some add the African *Polyboroïdes*), containing some 15 or 20 species of various parts of the world.

171. **CIR'CUS**. (Gr. *κίρκος*, *kirkos*, Lat. *circus*, a kind of hawk; from its circling in the air. Fig. 364.) HARRIERS. Bill thickly beset with many curved radiating bristles surpassing in length the cere, which is large and tumid; tomia lobed or festooned, but neither toothed nor notched. Nostrils ovate-oblong, nearly horizontal. Superciliary shield prominent. Tarsus long and slender, scutellate before and mostly so behind, reticulate laterally; toes slender, the middle with its claw much shorter than the tarsus; a basal web between the outer and middle; all tuberculate underneath; claws very large and sharp, much curved. Wings very long and ample; 3d and 4th quills longest; 1st shorter than 6th; outer 3–5 (in our species 4) emarginate on inner webs; 2d–5th emarginate on outer webs. Tail very long, about $\frac{2}{3}$ as long as the wing, nearly even or rounded, the folded wings falling short of its end. In our species, which scarcely differs from the European *C. cyaneus*, the sexes are extremely unlike in color and size; the old ♂ is chiefly bluish-gray and white; the ♀ and young of both sexes are dark brown and reddish-brown or tawny, with while rump; the ♀ is much larger than the ♂. The nest is placed upon the ground; the eggs are colorless or nearly so. The harriers are among the most "ignoble" of hawks, preying upon humble quarry, chiefly small quadrupeds, reptiles, and insects, for which they hunt by quartering low over the ground with an easy gliding flight. They are "light-weights" in proportion to their linear dimensions, all the members being lengthened, and the wings especially ample. The plumage is also loose and fluffy, somewhat like that of owls, to which the harriers are related in several respects.

FIG. 365. — Marsh Hawk, nat. size. (Ad nat. del. E. C.)

489. **C. cya'neus hudson'ius**. (Lat. *cyaneus*, blue, the color of the old ♂; *hudsonius*, of Hudson's Bay. Fig. 365.). AMERICAN MARSH HAWK, *or* HARRIER. BLUE HAWK. Adult ♂: In perfect plumage pale pearly-bluish, or bluish-ash, above, with the upper tail-coverts entirely pure white; but most specimens have a dusky wash obscuring the bluish, and retain traces of

brown or rufous. Five outer primaries mostly blackish, all of them and the secondaries with large white basal areas on inner webs; tail-feathers banded with 5 or 6 obscure dusky bars, the terminal one strongest and most distinct, and marbled with white toward their bases. The bluish cast invades the fore under parts, the rest of which are white, with sparse drop-shaped rufous spots; lining of wings white. From this blue-and-white state the bird is found grading by degrees into the very different plumage of the ♀ and young: Above, dark umber-brown, everywhere more or less varied with reddish-brown or yellowish-brown, the upper tail-coverts, however, *white*, forming a very conspicuous mark; under parts a variable shade of brownish-yellow, or ochraceous, streaked with umber-brown, at least on breast and sides; tail crossed with 6–7 blackish bars. The younger the bird the heavier the coloration, which is sometimes quite blackish and reddish, excepting the white upper tail-coverts. ♂ ♀: Iris, tarsi, and toes bright yellow; cere yellow or yellowish; bill blackish; claws black. ♂: length 17.50–19.00; extent 40.00–44.00; wing 13.00–14.00; tail 9.00–10.00; tarsus 3.00 or less; middle toe without claw 1.20. ♀: length 19.00–21.50; extent 45.00–50.00; wing 14.00–16.00; tail 9.50–10.50; tarsus 3.00 or more; middle toe without claw 1.40. North Am. at large, one of the most abundant and widely-diffused of its family, especially in meadowy and marshy places, and easily recognized by its generic characters, in all its variation of size and color. The nest is placed upon the ground, and rather neatly built of hay, a foot in diameter, 3 inches high; eggs 3–6? commonly 4–5, broad and nearly equal-ended, 1.80 to 1.90 × 1.40–1.45, dull white, with more or less greenish or bluish shade; no *decided* markings, but frequently small spots and large blotches of very pale brownish on the surface, and some neutral-tint shell-spots. No specific difference from *C. cyaneus* of Europe; averaging a little larger; old ♂ retaining a few rufous spots in white of under parts, and more evident barring of wings and tail.

43. Subfamily MILVINÆ: Kites.

Fig. 366. — A typical Kite (*Elanoides forficatus*). (From Michelet.)

No ruff or ear-conch. Loral bristles moderate, scanty or quite wanting, the head being then closely and softly feathered to the bill. Superciliary shield evident or not. Bill usually weak, sometimes extremely slender, the cutting edge of the upper mandible straight to the curve, or lobed or festooned, but not toothed, nor the under mandible truncate and notched. Nostrils not circular, nor with central bony tubercle. Wings very long, more or less narrowed and pointed, with several (in our genera 2 to 5) primaries emarginate on inner webs. Tail very variable in length and shape, in our genera nearly even or deeply forked. Feet very small; tarsus much shorter than tibia, approximately equal to middle toe without claw, — usually feathered above, the rest

mostly or entirely reticulate in small pattern (with few or no large transverse scutella). The general organization is buteonine; the scapular process of the coracoid does not meet the clavicle, the septum nasi is incompletely ossified, and the anterior ridge of the palate is little developed if at all; the superciliary shield is in one or two pieces. The kites form a rather extensive group of hawks of no great strength and less than average size, though very active, generally of lithe and graceful shape, with long thin wings and often forked tail. They are "ignoble" birds, subsisting upon small game, especially insects and reptiles. In *Pernis apivorus*, the bee-eating hawk of Europe, the whole head is densely and softly feathered to the bill. The group is less homogeneous than the others here presented, and might be, perhaps, dismembered, or merged in *Buteoninæ*. The genera assigned differ with nearly every writer who recognizes the group at all. The type of the group is the genus *Milvus*, near which stands our *Elanoïdes* (fig. 366), and with which it may not be improper to associate *Elanus*, *Ictinia*, and *Rostrhamus*.

Analysis of Genera.

Tail nearly as long as the wings, deeply forked; head closely feathered . . . . . *Elanoïdes* 175
Tail nearly or about even.
  Five outer primaries emarginate on inner webs; bill and claws extremely slender . . *Rostrhamus* 172
  Two outer primaries emarginate; tarsus scutellate in front . . . . . *Ictinia* 173
  —entirely reticulate . . . . . *Elanus* 174

172. **ROSTRHA'MUS.** (Lat. *rostrum*, a beak; *hamus*, a hook.) SICKLE-BILLED KITES. Bill extremely long and slender, the upper mandible hooked almost into a sickle-shape, the curvature also impressed to some extent upon the under mandible; cutting edges entirely without tooth or lobe, but simply curved like the culmen; gonys straight. Cere contracted; nostrils narrowly oval, horizontal. Loral bristles slight. Space between bill and eye nearly naked and colored, as if a continuation of the cere. Wings long; 3d and 4th quills longest; 5th next; 1st shorter than 6th; outer 5 emarginate on inner webs. Tail about half as long as the wing, slightly emarginate or nearly even. Feet small; tarsus feathered about ½ way down in front, then scutellate, for the rest reticulate; middle toe and claw about as long as tarsus. Inner toe without claw shorter than outer ditto; inner toe and claw longer than ditto; no evident webbing between either of them; soles granular, but little tuberculate. Claws very long and acute, but slender and comparatively little curved; inner edge of the middle one dilated and jagged. A genus marked by the extreme hooking of the slender bill, otherwise near *Elanus;* containing two or three species of the warmer parts of America.

490. **R. socia'bilis plum'beus.** (Lat. *sociabilis*, gregarious; *plumbeus*, lead-colored.) EVERGLADE KITE. Adult ♂ ♀: General color blackish-plumbeous, blackening on wings and tail. Base of tail, with longer upper coverts and all under coverts white, increasing in extent on the tail from middle to lateral feathers; tail also with a pale gray or whitish terminal zone. Bill and claws black; base of bill, cere and feet bright orange, drying dingy yellow; iris red. Length 16.00–18.00; extent about 44.00; wing 13.50–15.50; tail 6.50–7.50; bill 0.90–1.00; tarsus 1.75–2.25; middle toe without claw, rather less. Young birds are much varied with brown, yellowish, and white, but the species is unmistakable in any plumage. Florida and the West Indies; said to be common in the "everglades," and to resemble the marsh hawk in habits; nest in a bush, eggs commonly two, whitish, irregularly spotted, blotched, or smirched with brown, about 1.72 × 1.45. Compared with the S. Am. *R. sociabilis*, the Florida bird averages larger, lighter-colored, and weaker-billed.

173. **ICTI'NIA.** (Gr. ἰκτῖνος, *iktinos*, a kite. Fig. 367.) LEAD KITES. Bill rather small, but robust, very deep and wide for its length; tip of upper mandible much overhanging, its cutting edge very prominently lobed, sometimes almost toothed like a falcon's, sometimes irregularly sinuate-serrate; the nick just in front of the lobe usually permitting the median ridge of the palate to be visible from the side; culmen very strongly arched in nearly a quadrant of a circle;

gonys convex, ascending; rictus short; nostrils small, subcircular; basal bristling slight; supercilliary shield small, in one piece. Wings of moderate length, ample; 3d quill longest; 2d but little shorter; 1st quite short, about equal to 5th; outer 2 emarginate on inner web, and next 2 somewhat sinuate. Tail moderate, even or emarginate, the feathers broad to their obtusely rounded ends. Feet short and stout; tarsus scutellately reticulated about ⅓ way down in front, then semitllate, for the rest reticulate; middle toe without claw about as long as the tarsus; outer and middle toes connected by a basal web for the whole length of the basal joint of the latter; inner toe without claw shorter than the outer, with claw longer, its claw being much larger than that of the outer toe, reaching beyond base of middle claw. Soles broad, especially under

Fig. 67. — Left, Mississippi Kite, ⅔ nat. size; right, Swallow-tailed Kite, ¼ nat. size. (From Brehm.)

the hind toe, which is widely marginal; claws short, stout, much curved. A genus of two species, confined to temperate and tropical America; of great volitorial power, spending much of their time on the wing in aerial gyrations; somewhat gregarious like other *Milvinæ*, and preying upon the humblest quarry, especially insects and small reptiles, often feeding from their talons, as they sail through the air, after sweeping down upon their prey and seizing it as they pass without staying their flight.

491. **I. subcœrulea.** (Lat. *subcæruleus*, bluish.) MISSISSIPPI KITE. Adult ♂ ♀: General plumage plumbeous or dark ashy-gray, bleaching on the head and secondaries, blackening on the tail and wings, several primaries more (♂) or less (♀) suffused with chestnut-red on the inner

web or on both webs. Forehead and tips of secondaries usually silvery-whitish; concealed white spots on the scapulars; bases of feathers of head and under parts fleecy-white. Lores, eyelids, and bill, including cere, black; gape of mouth and feet, orange, the latter obscured on the front of the tarsus, and along the tops of the toes; iris lake-red. Feet and cere drying to a nameless dingy color. Length of ♂ about 14.00; extent 36.00; wing 10.50–11.50; tail 6.00–6.50; tarsus 1.45; ♀ about 15.00; wing 11.00–12.50; tail 6.50–7.00. Young: Head, neck and under parts whitish, spotted with dark brown or reddish-brown, excepting on the throat and along a superciliary line; lining of wings tawny, spotted with rusty-brown; upper parts blackish, most of the feathers edged with tawny-white; quills tipped with white; tail black, with about 3 pale ashy bands, and as many rows of white spots on the inner webs. Southern U. S., regularly N. to South Carolina, Illinois and Indian Territory, casually to Pennsylvania, Iowa, and Wisconsin; S. into Mexico; replaced in Central and S. Am. by the related but quite distinct *I. plumbea*. Nest of sticks, etc., in trees; eggs ?

174. **E'LANUS**. (Lat. *elanus*, a kite.) PEARL KITES. Related to the last; general form and aspect similar. Pattern of coloration entirely different. Bill rather weak and compressed, the tomia of the upper mandible devoid of lobe or festoon, but slightly sinuate to the overhanging tip; gonys about straight; culmen less strongly convex than in *Ictinia;* nostrils subcircular, near middle of the moderate cere. Feet very small; tarsus feathered half-way down in front, for the rest finely reticulate, like the tops of the toes to near their ends; hind toe very short; claws all small and little curved; basal web between middle and outer toes slight (compare feet of *Ictinia*). Wings nearly or about twice as long as tail; pointed, 2d and 3d quills longest, 1st about equal to 4th, 1st and 2d emarginate on inner webs. Tail emarginate, but outer feather shorter than the next, all the feathers broad to their obtusely-rounded ends. A small genus of 4 or 5 species inhabiting the warmer parts of the world.

492. **E. glau'cus**. (Lat. *glaucus*, bluish.) BLACK-SHOULDERED KITE. WHITE-TAILED KITE. Adult ♂ ♀: Upper parts pale bluish-ash; most of the head, the whole tail, and entire under parts, including lining of the wings, pure white; lesser and middle wing-coverts black, forming a great black area; a patch on under wing-coverts, the shafts of most tail-feathers, and a loral spot, also black. The white of the under parts and middle tail-feathers often with a pearly bluish cast. Bill and claws black; cere and feet yellow or orange; iris red or reddish. Length 16.00–17.00; extent 39.00–41.50; wing 12.50–13.50; tail 7.00–8.00; tarsus 1.30; middle toe without claw about the same; ♀ little larger than ♂. Young marked with dusky and reddish-brown, the wing-feathers white-tipped, the tail-feathers with a subterminal ashy bar. In this species the tail is emarginate to a depth of about 0.50, the outer tail-feather also about as much shorter than the next, which is the longest one. Southern U. S. from Atlantic to Pacific; N. to South Carolina, Illinois, Indian Territory, and Middle California; S. through Central and most of S. Am.; common. With habits in general like those of the last species, this elegant kite is stronger and more predaceous, preying upon small birds and quadrupeds as well as insects and reptiles. It nests in trees and bushes; eggs 4–6, subspherical, 1.60 × 1.45, whitish, blotched and smirched with mahogany color.

175. **ELANOI'DES**. (Lat. *elanus*, and Gr. εἶδος, *eidos*, resemblance.) SWALLOW-TAILED KITES. Prominently characterized by the extremely elongated and deeply forficate tail, the length of which nearly equals that of the wing, the narrow, acuminate lateral feathers being more than twice as long as the middle pair when full grown. Wings also very long, thin and acute; 2d and 3d quills forming the point; 1st about equal to 4th; 1st and 2d emarginate on inner webs. Feet very short, but stout; tarsus feathered about ½ way down in front, elsewhere irregularly reticulate; toes mostly scutellate on top, but reticulate toward their bases, granular and padded underneath; claws short, stout, strongly arcuate, scooped out underneath, with sharp edges, that of the middle dilated. Bill rather weak, with moderately convex culmen and small cere; the cutting edge festooned. Nostrils oval, oblique. Head closely feathered on the sides:

a small superorbital shield of a single bone. A beautiful genus of a single species, related to the Old World *Milvus* (typical kites) and especially to *Nauclerus*, with which latter it has usually been associated.

493. E. forfica'tus. (Lat. *forficatus*, deeply forked. Figs. 366, 367.) SWALLOW-TAILED KITE. Adult ♂ ♀: Head, neck, band on rump, and entire under parts, including lining of wings, snow-white; back, wings, and tail, glossy black, with various lustre, chiefly green and violet. Bill [illegible]: cere, edges of mandibles, and feet pale bluish, the latter tinged with greenish; claws light-colored. Length about 24.00, but very variable; extent 50.00; wing 15.50–17.50; tail up to 14.50, cleft more than ½ its length; tarsus about 1.25; middle toe without claw rather less. Young: Similar; less lustrous; wing- and tail-feathers white-tipped; feathers of head and neck pencilled with delicate shaft lines of blackish. This most elegant kite, superlative in ease and grace of the wing, floats, soars, and dashes over the greater part of America, and even crosses the Atlantic on its buoyant pinions. It is abundant in the Southern U. S., sometimes winging its way to the Middle States, and regularly up the whole Mississippi valley, to Minnesota and Dakota, latitude 49°. Known to nest from Wisconsin and Iowa southward. The nest is placed on a tree, constructed of sticks, hay, moss, etc.; eggs 4–6, whitish, 1.90 × 1.50, irregularly blotched and speckled with rusty and chestnut-brown.

44. Subfamily ACCIPITRINÆ: Hawks.

FIG. 368.—A typical Accipitrine. (From Dixon.)

General form strict, with small head, shortened wings, and lengthened tail and legs. Tarsi approximately equal to the tibia in length. Bill short, robust, high at base; toothless, but usually with a prominent festoon; no central tubercle in the broadly oval nostril, nor keel of palate anteriorly. Superciliary shield prominent. Coracoid arrangement as in *Buteoninæ*, into which group the present one grades. Wings concavo-convex, the 3d to 6th quills longest, the 1st very short and more or less bowed inward, the outer 3 to 5 emarginate or sinuate on inner webs. Tail quite long, square or rounded, sometimes emarginate, nearly equalling the wing in length. Tarsi slender, longer than middle toe without claw, usually extensively if not completely denuded of feathers, and scutellate before and behind. This is an extensive group of medium-sized and small hawks, little if at all inferior in spirit of audacity to the true falcons, though less powerfully organized and in fact conforming in anatomical characters with the *Buteoninæ* rather than with the *Falconinæ*. In the technic of falconry, the *Accipitrinæ* are styled "ignoble," because these short-winged hawks rake after the quarry, instead of plunging upon it like the "noble" long-winged falcons. Their flight is swift and darting; they capture their prey in open chase with amazing celerity and address, always killing for themselves and disdaining carrion. Their quarry is chiefly birds and quadrupeds. *Astur* and *Accipiter* are the typical and principal genera, of which some 50 species (chiefly of the former genus) are known, inhabiting most parts of the world. Our representatives of these genera are easily discriminated, but some exotic species connect them quite closely.

Analysis of Genera.

Small and medium-sized; length 20.00 or less. Tarsus more extensively denuded, and scutellate, sometimes booted . . . . . *Accipiter* 176

Large; length over 20.00. Tarsus less extensively denuded, and scutellate, never booted . . . *Astur* 177

176. **ACCIPITER.** (Lat. *accipiter*, a hawk. Fig. 368.) SHARP-SHINNED HAWKS. Tarsi feathered about ⅓ way down in front, or less (in *Astur* about ½ way), and quite slender (whence the term "sharp-shinned"); in one species prominently and continuously scutellate before and behind, the scutellation continued on to the toes; in the other the same, or finally fused in a continuous "boot." Toes long, slender, the outer one much webbed at base and padded underneath; inner claw much larger than the middle one, approximately equalling the hind claw; height

FIG. 369. — *Accipiter nisus* of Europe, adult ♂, ½ nat. size; not distinguishable in a cut from our Sharp-shinned Hawk; taken as of ⅓ nat. size it would represent Cooper's Hawk just as well; at ¼ it would do duty for a Goshawk. (From Brehm.)

of bill at base greater than chord of culmen; 4th and 5th quills longest, 3d and 6th next, 2d shorter than 6th, 1st very short. The two following species are exactly alike in color; one is a miniature of the other. The ordinary plumage is dark brown above (deepest on the head, the occipital feathers showing white when disturbed), with an ashy or plumbeous shade which increases with age, till the general cast is quite bluish-ash; below, white or whitish, variously streaked with dark brown and rusty, finally changing to brownish-red (palest behind and

slightly ashy across the breast), the white then only showing in narrow cross-bars; chin, throat and crissum white, with blackish pencilling, the crissum, however, usually immaculate; wings and tail barred with ashy and brown or blackish, the quills white-barred basally, the tail whitish-tipped; bill dark; claws black; iris, cere and feet yellow. Sexes alike in color; ♀ much larger than ♂.

Analysis of Species.

Feet extremely slender; bare portion of tarsus longer than middle toe; scutella frequently fused; tail square. ♂ 10.00–12.00; extent about 21.00; wing 6.00–7.00; tail 5.00–6.00. ♀ 12.00–14.00; extent about 25.50; wing 7.00–8.00; tail 6.00–7.00; whole foot 3.50 or less . . . . . *fuscus* 494

Feet moderately stout; bare portion of tarsus shorter than middle toe; scutella always distinct; tail rounded. ♂ 16.00–18.00; extent about 30.00; wing 9.00–10.00; tail 7.00–8.00. ♀ 18.00–20.00; extent about 35.00; wing 10.00–11.00; tail 8.00–9.00; whole foot 4.00 or more . . . . . *cooperi* 495

494. A. fuscus. (Lat. *fuscus*, dark. Fig. 369.) SHARP-SHINNED HAWK. "PIGEON" HAWK, so-called, but not to be confounded with *Falco columbarius*, No. 505. Adult ♂ ♀: Above, dark plumbeous, slate-color, or bluish-gray, somewhat more fuscous on the wings and tail than on the body, the feathers of the hind-head with fleecy white bases, the scapulars with concealed white spots. Tail crossed by about 4 blackish bars, the first under the coverts, the last subterminal and broadest; extreme tips of the feathers white. Primaries also marked with blackish bars or spots, and whitening at their bases, in bars or indents of the inner webs. Under parts barred crosswise with rufous on a white ground, the bars on some parts cordate and connected along the shafts of the feathers, which are blackish; ear-coverts rufous; rufous mostly or entirely wanting on the cheeks, throat, and crissum, which are more or less finely pencilled with the black shafts of the feathers; crissum, however, often pure white. Axillars barred like other under parts; lining of wings white, with dusky spots. Dimensions as above. Young: Above, umber-brown, varied with rusty-brown edgings of most of the feathers; white spots of scapulars exposed. Below, white more or less tawny-tinged, striped lengthwise with dark brown or reddish-brown on most parts, the feathers mostly black-shafted. This state is oftener seen than the perfected plumage; every intermediate stage is seen; but there can be no misunderstanding the species, as our only other hawks (*Falco columbarius* and *F. sparverius*) of similar slight dimensions belong to a different genus and subfamily. N. Am. at large, one of our most abundant hawks, and one which, notwithstanding its smallness, sustains the reputation of *Accipitrinæ* for nerve and prowess. The nest is usually built in the branches of a tree, sometimes in a hollow or on a ledge of rocks, being a platform of small sticks upon which rests a bed of hay, moss, leaves, or bark; the eggs are generally laid in May, to the number of 4 or 5. The white ground-color has often a livid or even purplish tint, and is marked, often so thickly as to be obscured, with large, irregular splashes of various shades of brown, interminably changeable in number, size, and pattern, sometimes inclining to form masses or a wreath, sometimes more evenly distributed. The egg is of nearly equal size at both ends, and measures about 1.45 × 1.15. It is not distinguishable with certainty from that of *Falco columbarius*.

FIG. 370. — Beak and talons of *Accipiter* (*A. cooperi*, nat. size). (Ad nat. del. E. C.)

495. A. coo'peri. (To Wm. Cooper. Fig. 370.) COOPER'S HAWK. CHICKEN HAWK (a name shared

by species of *Buteo*). The colors and changes of plumage of this species being practically the same as those of *A. fuscus*, need not be repeated. The chief difference is, that the crown of the adult is usually appreciably darker slate than the back; the white scapular spots are smaller, fewer, or wanting; in high plumage the upper parts are clearer bluish, while the breast has a fine glaucous bloom overlying the rufous and white ground-color; the tail is more decidedly white-tipped. A small ♂ *cooperi* grades in size nearly down to a large ♀ *fuscus*, but there appears to be constantly a difference of a couple of inches of total length at least; and in any event, the other characters above given will suffice for their discrimination. In either species, the yellow of the cere and feet is often or usually obscured with greenish. In *cooperi*, the tarsal scutella are sometimes less distinct than is normal, but are not known to fuse into a boot. A large ♀ not distantly resembles a *young male* Goshawk; but the difference in feathering of the tarsus is distinctive. Temperate N. Am. at large, and southward; one of the common "chicken" hawks, and a fellow of great audacity and prowess, preying on birds up to the size of grouse and domestic poultry. Nesting as described for *A. fuscus*. The eggs I have examined measure from 1.80 × 1.45 to 2.10 × 1.60 (figures showing the variation both in size and shape), averaging about 1.90 × 1.50. They resemble those of the marsh hawk so closely as not to be certainly distinguishable, but are usually more globular, and with a more granulated shell. The greatest diameter is at or very near the middle; difference in shape of the two ends is rarely appreciable. All are more uniform in color than those of most hawks, resembling the pale, scarcely-marked examples occasionally laid by most kinds; none are conspicuously dark-marked. The ground is white, faintly tinted with livid or greenish-gray; if marked, it is with faint, sometimes almost obsolete, blotches of drab, liable to be overlooked without close inspection; only an occasional specimen is found with decided, though still dull and sparse, markings

FIG. 371. — European Goshawk, *young* ♂. ¼ nat. size, not distinguishable in the cut from the American Goshawk; change of scale to ⅓ or ½ would make it represent the young ♂ Cooper's or Sharp-shinned Hawk. (From Brehm.)

of pale brown. Three or four eggs are the usual nest-complement; in the Northern and Middle States they are laid in May.

177. AS'TUR. (Lat. *astur*, a hawk.) GOSHAWKS. Characters in general as above given for *Accipiter;* size superior, and organization more robust; feet stronger, the tarsus feathered about ⅓ way down in front and on the sides, leaving only a narrow bare strip behind; the scutellation discontinuous at the bases of the toes, which are finely reticulate; resumed beyond; never fused. These "goose-hawks" or "star-hawks" are a small genus of five or six "ignoble" species, held in high estimation by falconers for their prowess in the chase. Ours appears to be quite distinct from *A. palumbarius*, though closely related.

496. A. atricapil'lus. (Lat. *atricapillus*, black-haired. Fig. 371.) AMERICAN GOSHAWK. BLUE HEN HAWK (adult). CHICKEN HAWK (young). Adult ♂ ♀: Above, dark bluish-slate color, each feather black-shafted; top of head blackish, conspicuously different from other upper parts, the feathers there with fleecy white bases; a long white superciliary or rather post-ocular stripe; auriculars blackish. Ground color of under parts, including lining of wings, white, closely barred or vermiculated in narrow zigzag lines with slaty-brown, except on throat and crissum, and everywhere sharply pencilled with blackish shaft-lines, one on each feather. The barring is largest and most regular on the belly, flanks, and tibiæ, but is for the most part much dissipated in a fine mottling. It varies greatly in coarseness in different specimens, some of which approach *A. palumbarius* in this respect. Tail like back, banded with four or five blackish bars, the terminal one much the broadest. Bill dark bluish; iris yellowish; feet yellow, claws black. Wing-quills in similar pattern, and both these and the tail showing tendency to some whitish mottling of inner webs of the feathers. Young: The difference is substantially as in species of *Accipiter:* above, dark brown, varied with rusty-brown and whitish; below, white, more or less tawny-tinged, with oblong, lance-linear, clubbed or drop-shaped dark brown markings. Tail more distinctly barred than in the adult, and with white tip. But in any equivocal plumage, the goshawk may be recognized by its size, which is that of an average *Buteo*, together with the short rounded wings, very long fan-shaped tail, and other generic characters. Length of ♂ 20.00–22.00; extent about 42.00; wing 12.00–13.00; tail 9.00–10.00; tarsus 2.75; middle toe without claw 1.75; chord of culmen without cere 0.90; ♀, length 22.00–24.00; extent 45.00 or more; wing 13.00–14.00; tail 11.50–12.50. A large, powerful, and when in perfect plumage, a very handsome hawk, of splendid spirit, the terror of the poultry-yard. A larger, brighter, and altogether better bird than the European. It inhabits northern N. Am.; the northern half of the U. S. chiefly in winter, but is also resident in some parts, and breeds in mountainous regions as far south at least as Colorado, where I have seen it in summer. Its ordinary quarry is grouse, ptarmigan, and hares. The nesting and the eggs, as described, are most like those of *Accipiter cooperi;* the eggs, probably only distinguishable by their supe-

FIG. 372.—Prairie Falcon, ⅛ nat. size. (From life, by H. W. Elliott.)

rior size, measuring about 2.30 × 1.90, soiled whitish, "marked irregularly with large but quite faint blotches of drab and yellowish-brown."

497. A. a. stria'tulus? (Lat. *striatulus*, finely striped.) WESTERN GOSHAWK. Described as having the markings of the under parts so fine and dense as to present a nearly uniform bluish-ashy nebulation, pencilled with fine black-shafted lines. Rocky Mts. to the Pacific. (Probably untenable.)

45. Subfamily FALCONINÆ: Falcons.

FIG. 373. — A "noble" Falcon. (From Michelet.)

Bill furnished with a sharp tooth and notch near the end of the cutting edge of the upper mandible (sometimes two such teeth), and end of under mandible truncated, with notch near the tip (figs. 372, 374). Nostrils circular, high in the cere, with a prominent central tubercle (fig. 372). Inter-nasal septum extensively ossified. Palate with a median keel anteriorly. Superciliary shield prominent, in one large piece. Shoulder-joint strengthened by union of scapular process of the coracoid with the clavicle (fig. 362) as in *Micrastur*, *Herpetotheres*, and the *Polyborinæ* alone of *Falconidæ*. Wings strong, long, and pointed, with rigid and usually straight and tapering flight-feathers; the tip formed by the 2d and 3d quills, supported nearly to their ends by the 1st and 4th, both of which are longer than the 5th; only one or two outer primaries emarginate on inner webs near the end. Tail short and stiff, with more or less tapering rectrices. Feet strong, rather short, the tarsus of less length than the tibia, feathered more or less extensively, elsewhere irregularly reticulate in small pattern varying with the genera or subgenera; never scutellate in single series before or behind. Middle toe very long; talons very strong. The true *falcons* are thus eminently distinguished from other members of the family; a glance at the toothed beak suffices for their recognition. They are birds of medium and small size, some kinds being not larger than a sparrow, but extremely sturdy organization, vigorous physique, and temerarious disposition. They capture their quarry with sudden and violent onslaught, and exhibit the raptorial nature in its highest degree. The typical and principal genus is *Falco*, of which there are several subdivisions corresponding to minor modifications. Upwards of fifty species are recognized. Our rather numerous species represent the several grades of gyrfalcons, lanners, peregrines, merlins, and kestrels. These I shall consider under one genus, *Falco*, with indication of the subgenera.

FIG. 374. — Peregrine Falcon, greatly reduced. (From Tenney, after Wilson.)

FIG. 375. — Kestrel Falcon, like our Sparrow-hawk (*Tinnunculus*), reduced. (From Dixon.)

178. FAL'CO. (Lat. *falco*, a falcon or faucon.) Characters as above, with minor modifications as follows: —

Analysis of Subgenera and Species.

Tarsus more or less feathered above, elsewhere irregularly reticulate in small pattern (no large plates like scutella); 2d primary longest; 1st longer than 4th, and decidedly emarginate on inner web. (*Gyrfalcons, lanners,* and *peregrines.*)

Gyrfalcons: Tarsus feathered fully ½ down in front and on sides, leaving but a narrow strip bare behind; longer than middle toe without claw; 1st quill shorter than 3d. Sexes alike. Very large; about 2 feet long. (HIEROFALCO.)

Prevailing color dark; head and neck darker than back . . . . . *sacer* 498, 499
Prevailing color dark; head and neck lighter than back . . . . . *islandicus* 500
Prevailing color white . . . . . *candicans* 501

Lanners: Tarsus feathered ⅓ way down in front, broadly bare behind; longer than middle toe without claw; 1st quill shorter than 3d. Medium; grayish-brown above; sexes alike. (GENNAIA.) . . . . . *mexicanus* 502

Peregrines: Tarsus feathered but a little way down in front, broadly bare behind; not longer than middle toe without claw; 1st quill not shorter than 3d. Medium: slaty-bluish above; sexes alike. (FALCO.) . . . . . *peregrinus* 503, 504

Tarsus scarcely feathered above, with the plates in front enlarged, like a double row of alternating scutella (and often with a few true scutella at base); 2d or 3d primary longest; 1st not longer than 4th; 1st and 2d emarginate on inner webs. (*Merlins* and *Kestrels.*)

Merlins: Tarsus longer than middle toe without claw. Sexes unlike; young of both like adult female. Small; wing 7.50–8.50. (ÆSALON.) . . . . . *columbarius* 505, 506, 507

Kestrels: Tarsus longer than middle toe without claw. Sexes very unlike at all ages. Smallest: wing 7.00–7.50. (TINNUNCULUS.)

Under parts white or tawny; back of male and female rufous, barred or plain *sparverius* 508, 509
Under parts rufous; back of male plumbeous, of female rufous . . . . . *sparverioïdes* 510

Hobbies: Tarsus little longer than middle toe without claw. Sexes alike; young little different. Medium; wing 10.00 or more (RHYNCHOFALCO.) . . . . . *fuscicærulescens* 511

498. F. sa'cer. (Lat. *sacer*, sacred.) AMERICAN CONTINENTAL GYRFALCON. One of the largest and most powerful of the *Falconinæ*. Feet very stout; tarsus rather longer than middle toe without claw, feathered fully half-way down in front and on sides, with narrow bare strip behind; elsewhere reticulate. Wing pointed by 2d quill, supported nearly to the end by the 3d; 1st rather shorter than 3d, only the 1st decidedly emarginate on inner web. Tail rounded. Sexes alike. Young little different. Wing of ♂ 13.50–14.50; tail 8.50–9.50; wing of ♀ 15.00–16.00; tail 9.00–10.00. Adults: General plumage of the upper parts barred with dark brown and pale ash, the former predominating, especially on the head and neck; tail closely barred with light and dark in about equal amounts. Lower parts white, immaculate on throat, elsewhere streaked and variously spotted with dusky. Young darker than the adults; at an early stage, some of the lighter markings tinged with ochraceous. This is the stock-form of Continental N. Am., probably inseparable from *F. gyrfalco* of Europe; the distinctions from *F. islandicus* being moreover not very apparent. I suspect the truth to be, in respect to all the gyrfalcons, that there is but a single circumpolar species; that with specimens enough an uninterrupted series could be established connecting the blackest "obsoletus" with the whitest "candicans"; and that the races even, which most ornithologists recognize, are not coincident with geographical areas. But I defer in this case to those authorities who have formed the contrary opinion, upon much further investigation of the subject than I have ever made. Gyrfalcons of the present kind, or of Nos. 499, 500, not infrequently visit the Northern States in winter, sometimes even reaching the Middle States and Kansas. They reside in summer beyond the U. S., and abound in the Arctic regions, nesting in trees or cliffs, preying upon hares, grouse, ptarmigan, ducks, auks, etc. The eggs range from 2.25 to 2.50 in length, × 1.60 to 1.90 in breadth, and are usually heavily colored with reddish and brownish pigments in interminable variety.

499. F. s. obsole'tus. (Lat. *obsoletus*, unwonted.) LABRADOR GYRFALCON. A dark phase of the last, almost entirely dusky, the usual markings nearly obliterated; from the foggy coast of

Labrador into U. S. in winter. (*F. labradora*, Aud., folio pl. 196.) I have seen it perfectly dark, — no markings whatever.

500. F. islan'dicus. (Lat. form of Icelandic.) ICELAND GYRFALCON. Resembling *F. sacer* as above described, and probably not fairly separable; on an average lighter colored, more extensively white below, the head and neck lighter than the rest of the upper parts. This form occurs in Iceland and southern Greenland, straggling in winter into the N. E U. S.

FIG. 376. — Lanner Falcon, ⅓ nat. size; not distinguishable in the cut from the Prairie Falcon. (From Brehm.)

501. F. can'dicans. (Lat. *candicans*, whitening.) GREENLAND GYRFALCON. The extreme form, averaging when adult as white as a snowy owl. Head, neck, and under parts pure white, with few dark touches if any. Back, wings and tail with white and dusky in about equal amounts, or former rather prevailing, giving the ground color, on which the dark appears in bars, crescents, and cordate spots. Bill and feet light. This form is characteristic of Greenland, straying south in winter; but I know of no case of its occurrence in the U. S.

502. **F. mexica'nus.** (Lat *mexicanus*, Mexican. Fig. 376.) AMERICAN LANNER FALCON. PRAIRIE FALCON. A medium-sized species, distinguished from any gyrfalcon by the smaller size, different feathering of the tarsus, etc.; from the duck hawk by the general much lighter color, which is dull brownish above instead of dark slate, etc. Adult ♂ ♀: Upper parts brownish-drab, each feather with a paler border of brown, grayish, or whitish; the top of the head more uniform, the occiput and nape showing more whitish. Under parts white, everywhere excepting on the throat marked with firm spots of dark brown, most linear on the breast, then more broadly oval on the belly, enlarging and tending to merge into bars on the flanks, very sparse or obsolete on the crissum, in the maxillary region forming a broad firm moustache; these markings corresponding with the ground color of the upper parts. Primaries ashy-brown, with narrow but firm pale edging of outer webs and ends, the inner webs regularly marked with white in form of barred indents or circumscribed spots, most numerous and regular on the outer few primaries; the white tinged with fulvous, next to the shafts; the outer web of the first primary either plain, or with whitish indents as in *F. lanarius*; outer webs of secondaries more or less marked with fulvous; axillars plain dark brown; lining of wings otherwise white, spotted with dark brown. Tail pale brownish-gray, nearly uniform, but with white tip, and more or less distinct barring or indenting with whitish, especially on the lateral feathers, producing a pattern not unlike that of the primaries. Bill mostly dark bluish horn-color, but its base, and much of under mandible, yellow; feet yellow. Young birds have more fulvous in the dark ground of the upper parts; are more heavily spotted below, and the white is there tinged with buff or ochrey, feet plumbeous. Size very variable: length of ♂ about 18.00, extent 40.00; wing 12.00–13.00; tail 7.00–8.00; tarsus about 2.00; middle toe without claw about the same; chord of culmen, including cere, 1.00. ♀ larger: wing 13.00–14.00; tail 8.00–9.00, etc. A noble species, representing the Old World lanner and jugger, and scarcely separable therefrom; abundant in Western N. Am., especially on the plains; E. occasionally to Illinois. I have traced it from Montana at lat. 49° to Arizona and S. California, and found it very numerous in Wyoming, where it is the characteristic species of its genus; it extends into Mexico. In the region first named it was nesting on cliffs. Eggs 2–3, from 2.05 to 2.25 × 1.55 to 1.65, white or creamy-whitish, irregularly but usually thickly clouded, mottled, and blotched with reddish-brown; often with a purplish shade; thus indistinguishable from those of related species. (*F. polyagrus* Cass.)

503. **F. peregri'nus.** (Lat. *peregrinus*, wandering. Fig. 377.) PEREGRINE FALCON. DUCK HAWK. GREAT-FOOTED HAWK. A medium-sized falcon, about as large as the foregoing, but known at a glance from any bird of N. Am. by the slaty-plumbeous or dark bluish-ash of the upper parts, the black "moustache," and other marks, taken with its particular size and shape. Wings stiff, long, thin, pointed by the 2d quill, supported nearly to its tip by 1st and 3d; 1st quill alone abruptly emarginate on inner web, this about 2 inches from its tip; none cut on outer webs. Tomium of upper mandible strongly toothed, of under mandible deeply notched. Tarsus feathered but a little way down in front, otherwise entirely reticulate; toes very long, giving great grasp to the talons. Adult ♂ ♀: Above, rich dark bluish-ash or slate-color, —very variable, sometimes quite slaty-blackish, again much lighter bluish-slate; the tint pretty uniform, whatever it may be, over all the upper parts, but all the feathers with somewhat paler edges, and the larger ones for the most part obscurely barred with lighter and darker hues. Under parts at large varying from nearly pure white to a peculiar muddy buff color of different degrees of intensity; the throat and breast usually free from markings (or only with a few sharp shaft pencillings), and this white or light color mounting on the auriculars, so that it partly isolates a blackish moustache from the blackish of the side of the head; the under parts, except as said, and including the under wing- and tail-coverts closely and regularly barred, or less closely and more irregularly spotted, with blackish; the bars best pronounced on the flanks, tibiæ, and crissum, other parts tending to spotting, which may extend

forward to invade the breast (this is the rule in European birds, the exception, though not a rare one, in American birds). Tail and its upper coverts regularly and closely barred with blackish and ashy-gray, the interspacing best marked on the inner webs, and all the feathers narrowly tipped with white or whitish. Primaries all showing uniform blackish on their exposed surfaces, but on the inner webs seen to be marked with numerous regular and close-set spots of white, whitish, or muddy buff, for the most part isolated within the webs, but on the

FIG 377. — Peregrine Falcon, or Duck Hawk, ⅛ nat size. (From Brehm.)

inner primaries and secondaries, and toward the bases of all, becoming or tending to become bars reaching the edge of the feather. Bill blue-black; cere and much of base of bill yellow; feet yellow; claws blackish. Size very variable; length of a good-sized ♀, 19.00; extent 45.00; wing 14.50; tail 7.00. ♂ averaging smaller; wing 12.50; tail 6.00; a usual range, sex not considered, is, wing 11.50–14.00; tail 6.00–8.00; tarsus 1.75–2.10; middle toe without claw rather more. Young: Recognizably similar to the adults in general characters; not barred below, but there more or less extensively and heavily streaked lengthwise; upper

parts brownish or blackish, in either case without the glaucous bloom and appearance of transverse markings which the adults show, the variegation being chiefly in light gray or rusty edgings of individual feathers. This falcon is the central figure in the whole genus, and in one or another of its geographical guises is cosmopolitan; it is universally but irregularly distributed in N. Am., scarcely to be considered common anywhere; breeds as far south as Virginia at least, usually in mountainous regions; nests indifferently on trees or cliffs or the ground; eggs 2–5, oftener 3–4, 2.10 to 2.35 × 1.60 to 1.75, averaging about 2.25 × 1.65; white or whitish, spotted, blotched, wreathed, clouded, etc., with the reddish-browns, from chocolate or even purplish to the ochres. The peregrine is a bird of noted prowess, habitually striking a quarry as large as itself or larger, as grouse, ducks, herons, hares, etc.

504. **F. p. peal'ii?** (To T. R. Peale.) PEALE'S PEREGRINE. A dark form, described from the N. W. coast. Dubious.

505. **F. columba'rius.** (Lat. *columbarius*, a pigeon-fancier.) PIGEON HAWK (a name also applied to *Accipiter fuscus*). Smaller than any of the foregoing; about the size of an *Accipiter fuscus*, but much stouter and differently proportioned. Tarsus mostly with a double row of alternating scutella in front, feathered but a little way down; middle toe without claw nearly as long as tarsus. Tail about ⅔ the wings, lightly rounded. Wings pointed by 2d and 3d quills, 1st about equal to 4th; 1st and 2d emarginate on inner webs near the end; 2d and 3d sinuate on outer webs. Sexes unlike; old ♂ bluish above, ♀ and young dark there. Old ♂: Above, some shade of bluish, from pale bluish-gray or bluish-ash to dark bluish-slate, each feather pencilled with a fine black shaft line. Tail banded with the color of the upper parts and black, about three zones of each, the subterminal black band broadest, all subject to much variation; tail tipped with white. Primaries blackish, with lighter edges or tips, and numerous oval transverse spots of white or whitish on the inner webs; outer webs often showing traces of ashy markings; a similar pattern continued on the secondaries. Under parts white, or whitish, generally pure and immaculate on the throat, elsewhere tinged with tawny or ochraceous, almost everywhere longitudinally streaked with dark umber-brown; the individual streaks very variable in size and distinctness, generally blackish-shafted, as a rule heavy and thick on the breast, more strict on the flags and vent, changing to spots or even bars on the flanks; these latter markings sometimes involved in a bluish clouding. Side of head with fine dark pencilling on a light or whitish ground, not gathered into a maxillary stripe, but coalescing on the ear-coverts; a pretty well defined light superciliary streak; markings of side of head confluent on nape, forming a nuchal band which interrupts the continuity of color of the upper parts. Iris brown; feet yellow; claws and most of bill bluish-black; cere and base of bill greenish-yellow. This plumage is comparatively seldom seen. Length about 11.00; extent about 23.50; wing 7.50–8.00; tail 5.00–5.50; tarsus 1.35; middle toe without claw 1.25. Adult ♀, and specimens of either sex, as usually observed: Pattern of coloration as before, but upper parts and tail quite different. Above, the bluish shade replaced by dark umber-brown, nearly uniform, or only interrupted by the nuchal band of streaks, but the feathers usually with appreciably paler edges, and black shaft-lines, the latter especially on the head. Tail like back, and tipped with white, and crossed by about four other narrow whitish or light ochraceous bands, formed of bars or transverse spots on both webs of the feathers; the uppermost of these bands lying under the coverts; there are generally only three exposed ones, besides the terminal one; the intervening dark zones are all of about the same width, say an inch, but the subterminal one is usually rather wider than the others. Pattern of quill-feathers as in the ♂, but the spots rather tawny or fulvous than whitish. Under parts as before, but the ground color ranging from nearly white to quite rich buff or even fulvous, and showing a wide range of variation in the heaviness of the streaking. Length of ♀ about 12.50; extent about 26.50; wing 8.00–8.50; tail 5.50–6.00. In quite young birds, the edgings of the feathers of the upper parts may be tawny or rufous. A spir-

ited little falcon, generally distributed in N. Am., common, representing the merlin of Europe, *F. æsalon*. Nests chiefly northerly, on branches or in holes in trees, or on rocks; eggs ranging in size and shape from 1.50 to 1.80 × 1.30, some being subspherical, others elongate-oval. The coloration ranges from a nearly uniform deep rich brown (chestnut or burnt sienna), to whitish or white, only marked with a few indistinct dots of dull grayish or drab. Such extremes are connected by every degree; a yellowish-brown ground-color, irregularly splashed with rich ruddy brown, is the usual style. The markings may be very evenly distributed, or mostly gathered in a wreath around one or the other end, or even both ends. The quarry is chiefly birds, even up to the size of a ptarmigan.

506. **F. c. suck'leyi?** (To Dr. Geo. Suckley.) A dark form, described from the N. W. coast. Dubious.

507. **F. c. rich'ardsoni.** (To Sir J. Richardson.) RICHARDSON'S PIGEON HAWK. AMERICAN MERLIN. "Adult ♂; Upper plumage, dull earth-brown, each feather grayish-umber centrally, and with a conspicuous black shaft-line. Head above, approaching ashy-white anteriorly, the black shaft-streaks being very conspicuous. Secondaries, primary-coverts, and primaries, margined terminally with dull white; the primary-coverts with two transverse series of pale ochraceous spots; primaries, with spots of the same, corresponding with those of the inner webs. Upper tail coverts, tipped and spotted beneath the surface with white. Tail, clear drab, much lighter than the primaries, but growing darker terminally, having basally a slightly ashy cast, crossed with *six* sharply defined perfectly continuous bands (the last terminal) of ashy-white. Head frontally, laterally, and beneath — a collar round the nape (interrupting the brown above) — and entire lower parts, white, somewhat ochraceous, this most perceptible on the tibiæ; cheeks and ear-coverts with sparse, fine, hair-like streaks of black; nuchal collar, jugulum, breast, abdomen, sides, and flanks, with a median linear stripe of clear ochre-brown on each feather; these stripes broadest on the flanks; each stripe with a conspicuous black shaft-streak; tibiæ and lower tail-coverts with fine shaft-streaks of brown, like the broader stripes of the other portions. Chin and throat, only, immaculate. Lining of the wings spotted with ochraceous-white and brown, in about equal amount, the former in spots approaching the shaft. Inner webs of primaries with transverse broad bars of pale ochraceous — eight on the longest. Wing 7.70; tail 5.00; culmen 0.50; tarsus 1.30; middle toe 1.25; outer 0.85; inner 0.70; posterior 0.50. Adult ♀: Differing in coloration from the male only in the points of detail. Ground-color of the upper parts clear grayish-drab, the feathers with conspicuously black shafts; all the feathers with pairs of rather indistinct rounded ochraceous spots, these most conspicuous on the wings and scapulars. Secondaries crossed with three bands of deeper, more reddish-ochraceous. Bands of the tail, pure white. In other respects exactly like the male. Wing 9.00; tail 6.10; culmen 0.55; tarsus 1.40; middle toe 1.50; Young ♂: Differing from the adult only in degree. Upper surface with the rusty borders of the feathers more washed over the general surface; the rusty ochraceous forming the ground-color of the head, — paler anteriorly, where the black shaft-streaks are very conspicuous; spots on the primary coverts and primaries deep reddish ochraceous; tail-bands broader than in the adult and more reddish; the terminal one twice as broad as the rest (0.40 of an inch), and almost cream color. Beneath, pale ochraceous, this deepest on the breast and sides; markings as in the adult, but anal region and lower tail-coverts immaculate; the shaft-streaks on the tibiæ, also, scarcely discernible. Wing 7.00; tail 4.60." (Ridgway.) Interior N. Am., especially from the Mississippi to the Rocky Mts.; very near the last, both being closely related to *F. æsalon*, the fewer bars on the wings and tail apparently the principal character. A ♀ I took in Dakota measures: length 12.75; extent 26.75; wing 8.50.

508. **F. sparve'rius.** (Lat. *sparverius*, a sparrower. Fig. 378.) RUSTY-CROWNED FALCON. SPARROW HAWK. Smallest of our *Falconinæ;* sexes unlike in color, but of nearly the same size,

contrary to the rule in this family. Tail rounded, at least ⅔ as long as the wing, usually more. Wings pointed by 2d and 3d quills: 1st about equal to 4th: 1st and 2d emarginate on inner webs near the end: 2d and 3d sinuate on outer webs. Tarsus feathered but a little way down in front, decidedly longer than middle toe without claw, usually surpassing middle toe and claw. Young differing less than usual from adults of their respective sexes. Adults: Crown ashy-blue, with a chestnut patch, sometimes small or altogether wanting, sometimes occupying nearly all the crown. Conspicuous black maxillary and auricular patches which, with three others around the nape, make seven places in all, usually evident, but some of them often obscure or wanting. Back cinnamon-rufous, or chestnut, like the crown-patch, in the ♂ with a few black spots or none, in the ♀ with numerous black bars. Wing-coverts of the ♂ fine ashy-blue, like the crown, with or without black spots: of the ♀ cinnamon-rufous and black-barred, like the back. Quill feathers in ♂, ♀ blackish, usually with pale edges and tips, and the inner webs with numerous white indentations, or bars continuous along the inner webs, leaving the black chiefly in a series of dentations proceeding from the shafts; ends of secondaries usually also slaty-blue like the coverts. Tail bright chestnut, in the ♂ with white tip, broad black subterminal zone, and outer feathers mostly white with several black bars, in the ♀ the whole tail with numerous imperfect black bars. Under parts white, variously tinged with buff or tawny, in the ♂ with a few black spots or none, in the ♀ with many dark brown streaks: throat and vent usually immaculate. Bill dark horn: cere and feet yellow or orange. Length, either sex, 10.00–11.00: extent 20.00–23.00: wing 6.50–8.00: tail 4.50–6.00: tarsus 1.35: middle toe without claw 1.00. The young do not require to be separately described, as the species is a strongly marked one, and as the young speedily acquire recognizable sexual characters. They may be distinguished when just from the nest. N. Am., everywhere very abundant. Despite its great variation in markings, aside from the normal sexual differences, this elegant little falcon will be immediately recognized by the subgeneric characters of *Tinnunculus*, its small size, and entirely peculiar coloration. Its characteristic habit is to hover or poise in the air over some object which seems to promise a meal, and then pounce down upon the prey. The birds are very active and noisy during the breeding season. They build no nest, but lay in the hollows of trees, often deserted woodpeckers' holes, or similar nooks in rocks or about buildings. Eggs 5–7, nearly spheroidal, about 1.33 × 1.12: ground-color usually buffy, or pale yellowish-brown: blotched all over with dark brown, the splashes of which are usually largest and most numerous toward the greater end, at or around which they may run into a crown or wreath. Some eggs are pale brown, minutely dotted all over with dark brown: some are white, with pale brown spots; and a few are whitish without any markings.

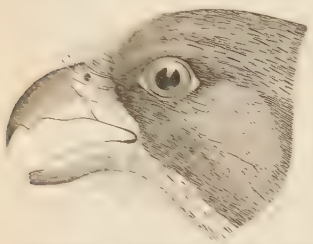


FIG. 378.—Sparrow Hawk, nat. size. (Ad nat. del. E. C.)

509. **F. s. isabellinus?** (Low Lat. *isabellinus*, color of a dirty chemise.) ISABEL SPARROW HAWK. A Middle American form of the last, occurring in the Gulf States, shading directly into *sparverius* proper: ♂ without rufous on crown: several lateral tail-feathers variegated, and the black zone an inch wide: black spots on back and sides very sparse: breast ochraceous. ♀ with the black bars of the upper parts very broad, upon a ferruginous ground.

510. **F. sparverioïdes.** (Lat. *sparverius*, and Gr. *eîdos*, *eidos*, likeness.) CUBAN SPARROW HAWK. Closely related to *F. sparverius*, and generally similar, but apparently a distinct species. ♂: "Above, except the tail, entirely dark plumbeous, with a blackish nuchal collar; primaries and edges and subterminal portion of tail-feathers, black. Beneath, deep rufous (like the back of *sparverius*) with a wash of plumbeous across the jugulum; throat grayish-white. Inner webs of primaries slaty, with transverse cloudings of darker. ♀ differing from that of

the above species in dark rufous lower parts, and dusky, mottled inner webs of primaries." (Ridgway.) Cuba; Florida.

511. **F. fusciœrules'cens.** (Lat. *fuscus*, dark; *cœrulescens*, bluish.) FEMORAL FALCON. APLOMADO FALCON. Quite different from any of the foregoing species, though belonging to the sparrow hawk group (*Tinnunculus*); it has been made a separate subgenus (*Rhynchofalco*). Bill robust, with large cere; irregular scutellation of tarsus continuous on the toes; tarsus a little longer than middle toe without claw; 2d and 3d quills longest; 1st about equal to 4th; 1st and 2d emarginate on inner webs; 2d and 3d sinuate on outer webs. Size medium (among the smaller falcons); form slender; sexes alike. Adult ♂ ♀: Above, uniform plumbeous; tail with about 8 narrow white bars, and tipped with white, as are the secondaries; primaries with numerous narrow white bars on inner webs, mostly being isolated transverse spots, reaching neither shaft nor inner edge of the feathers; the same pattern less definitely continued on to the secondaries. Side of head with a broad white or tawny postocular stripe, continuous with the narrowly white forehead, shading into orange-brown on the nape, where confluent with its fellow; auriculars mostly white, set in the black of the side of the head, but continuous with the white of the throat, so that a black supra-auricular stripe meets a black mystacial stripe under the eye. Sides of body and a broad belly-band black, with or without numerous narrow white bars; the extent of this black very variable; it usually leaves the breast white or tawny, but in younger specimens the whole breast is streaked with black on a tawny ground. Throat usually white. Lining of wings blackish, spotted with white, the border mostly white or tawny. Flanks, flags, and crissum uniform tawny or orange-brown. Young sufficiently similar, but upper parts rather dark brown than plumbeous. Length 15.00 or more; wing 10.00–11.00; tail 7.00–8.00; tarsus 1.75; middle toe without claw 1.50. A handsome hawk, well-known and wide-ranging in S. and C. Am., reaching just over our Mexican border. Nest in trees or bushes; eggs 1.80 × 1.65, white, finely dotted with light brown, overlaid with blotches of dark brown.

46. Subfamily POLYBORINÆ: Caracaras.

Anatomical characters of *Falconinæ* proper, in the scapular arrangement by which a process of the coracoid reaches the clavicle, the central tubercle of the extensively ossified nasal bones, the anterior keel of the palate, and the superorbital shield in a single piece; external characters very unlike those of *Falconinæ*, and general aspect vulturine. Bill toothless. Sternum single-notched on each side behind. Three or more primaries sinuate-emarginate on inner webs; 3d or 4th longest; 1st shorter than 5th. A small but remarkable group, combining some of the essential characters of falcons with others more vulture-like; the species are chiefly terrestrial, rather sluggish, and feed much on carrion. The genera are *Polyborus*, *Phalcobænus*, *Senex*, *Milvago*, *Ibycter*, and *Daptrius*, all confined to America.

179. **POLY'BORUS.** (Gr. πολυβόρος, *polyboros*, very voracious. Fig. 379.) CARACARAS. Bill long, high, much compressed, little hooked, the commissure nearly straight to the deflected end; cere ending anteriorly in a nearly straight vertical line; nostril high in the front upper corner of the cere, linear, oblique, its posterior end uppermost, its tubercle concealed. Chin and sides of head bristly, extensively denuded; a naked pectoral area; an occipital crest. Tibiæ shortly flagged. Tarsus nearly twice as long as middle toe without claw, almost entirely naked, chiefly reticulate, but in front broadly scutellate in single or double row; lateral toes of about equal lengths; hind toe much the shortest; claws long and little curved. Wings very long, with 3d and 4th quills longest, 2d and 5th next, 1st shorter than 6th or 7th; outer 4 or 5 emarginate. Tail rounded, about ⅔ as long as wing. Comprising two or three species of large vulture-like carrion hawks, of terrestrial habits, and ambulatorial, not saltatorial, gait, *P. cherivay*, *P. auduboni*, and *P. lutosus*, of the warmer parts of America.

535. **P. au'duboni.** (To J. J. Audubon.) COMMON CARACARA. Ad. ♂ ♀: General color blackish,

the throat, neck all around, and more or less of fore back and breast whitish, spotted and chiefly barred with blackish; upper and under tail-coverts and most of the tail white, the latter very numerously barred with blackish, of which color is the broad terminal zone; the shafts white along the white portion of each feather. Basal portion of primaries likewise barred with whitish. Bill variously pale colored; cere carmine; iris brown; feet yellow; claws black; soft parts drying to a dingy indefinable color. Young similar, but rather brownish, the markings of the body in lengthwise streaks, not cross-bars; tail, however, barred. Length (either sex) 21.00–23.00; extent about 48.00; wing 14.50–16.50; tail 8.00–10.00; tarsus about 3.60;

FIG. 379. — The Caracara, $\frac{1}{8}$ nat. size. (From Brehm.)

middle toe without claw 2.00. I describe the N. Am. bird, which is much less extensively barred than that of S. Am. (See Cassin, Pr. Phila. Acad., 1865, p. 2.) The difference in several specimens handled is striking, nearly the whole body, wings, and tail of the S. Am. bird being multitudinously rayed across, while in Texas and Florida specimens the body and wing-coverts are mostly uniform, the barring being restricted to the neck and fore half of the body, and to the primaries and tail-feathers. If I have compared age for age, the bird is certainly different. *P. lutosus* is barred throughout, and otherwise different again. S. border of U. S., Florida to L. Cala. and southward, common, in some places abundant, gregarious like a turkey-buzzard where offal is exposed. Nests bulky, in trees and bushes, of sticks and

leaves; eggs commonly 2, broadly oval or subspherical, heavily colored with blotches and clusters of rich reddish-brown and smaller blackish over-spots; size 2.20 to 2.40 by about 1.85. The long neck and legs of this bird, its terrestrial habits and walking powers, give it peculiar character, almost suggesting *Gypogeranus*. Like our vultures, it is a constant feature of the scene in some southerly localities.

47. Subfamily BUTEONINÆ: Buzzards and Eagles.

Bill variable in size and shape, but without the toothing and notching of that of *Falconinæ* (with rare exceptions), the cutting edge being variously lobed or festooned, or simple. Nostrils not circular, nor with a central tubercle; nasal septum incompletely ossified. Superciliary shield more or less prominent, usually consisting of two pieces. Scapular process of the coracoid not produced to meet the clavicle. Wings and tail variable, but not presenting the special characters noted under *Falconinæ*, nor the relative lengths of those of *Accipitrinæ*. Tarsus obviously shorter than the tibiæ, generally scutellate before and behind, sometimes feathered to the toes. The *buzzards* form a large group, not easy to define except by exclusion; though quite distinct from *Falconinæ* and *Polyborinæ*, they grade into each of the other subfamilies here presented. They are hawks of medium and rather large size, heavy-bodied, of strong but measured flight, inferior in spirit to the true hawks and falcons, and as a rule feed upon humble game, which they rather snatch stealthily than capture in open piracy. The extensive genus *Buteo* with its subdivisions, and its companion *Archibuteo*, typify the buzzards; they include, however, a great variety of forms. With them must be associated the *eagles;* for the popular estimate of these famous great birds as something remarkably different from ordinary hawks is not confirmed by examination of their structure, which is the same as that of other buzzards. Although usually of large size and powerful physique, they are far below the smallest falcons in raptorial character, prey like the buzzards, and often stoop to carrion. The genus *Aquila* may stand as the type of an eagle; its several species are confined to the Old World, with one exception. *Haliaëtus* represents a decided modification, in adaptation to maritime and piscivorous habits. A celebrated bird of this group is the harpy eagle, *Thrasyaëtus harpyia*, with immense bill and feet, and one of the most powerful birds of the whole family. There are several other genera in either hemisphere.

Analysis of Genera.

Tarsi feathered in front to the toes.
- Buzzards not over 2 feet long . . . . . *Archibuteo* 181
- Eagles about 3 feet long . . . . . *Aquila* 186

Tarsi naked and scutellate or reticulate below.
- Crested. Eagles about 4 feet long . . . . . *Thrasyaëtus* 185
- Not crested. No basal webbing of toes. Eagles about 3 feet long . . . . . *Haliaëtus* 187
- A basal web between outer and middle toes. Buzzards not over two feet long.
  - No tibial flag; outstretched feet reaching beyond tail . . . . . *Onychotes* 184
  - Tibiæ flagged; under parts of adult finely barred crosswise; wings rounded . . . . *Asturina* 182
  - —otherwise; wings more pointed . . . *Urubitinga*, 183, or *Buteo* 180

180. **BUTEO.** (Lat. *buteo*, a buzzard-hawk.) Buzzards. Size medium and large; form heavy, robust. Bill of moderate size and ordinary shape. Wings rather long and pointed, exceeding the tail to a variable extent; 3d to 5th quills longest, 1st to 5th emarginate on inner webs, 1st not longer than 8th. Tail of moderate length, probably averaging ⅔ of the wing, a little rounded. Feet more or less robust; tarsi scutellate in front at least, feathered in front for a varying distance; tibiæ flagged. This is the central or typical genus of its subfamily, as *Falco* is of *Falconinæ*, embracing numerous (about 30) species of nearly all parts of the world excepting Australia; about half of them American. The type is *B. vulgaris* of Europe, to which the N. Am. *B. swainsoni* is so closely related. Four of our species (*BB. borealis, swainsoni, lineatus*, and *pennsylvanicus*) are abundant "hen hawks" or "chicken hawks" of the U. S., the first named running into several varieties; the others are little known (*BB. harlani,*

cooperi), or of very partial distribution in N. Am. In all cases, the sexes are alike or similar; the ♀ is larger than the ♂; the young are different from the adults; melanism is frequently exhibited.

Analysis of Subgenera and Species.

Five outer primaries emarginate or sinuate on inner webs; tail more than ⅔ the wing; bill high at base; nostrils oval, with eccentric tubercle. (*Parabuteo.*)

Tail *blackish* (with white base and tip); lesser wing-coverts and tibiæ reddish; general plumage blackish. Southwestern U. S., common . . . . . *unicinctus* 512

Four outer primaries emarginate or sinuate on inner webs.

Tail *white*, with a broad black subterminal zone and numerous very narrow, zig-zag, or broken, blackish cross-lines. Texas . . . . . *albocaudatus* 513

Tail mostly white, ashy-clouded; marked *lengthwise* with rufous and darker; and with dark subterminal zone; under parts mostly white. Cala., one specimen known . . . . . *cooperi* 514

Tail mottled with dusky and white, and with subterminal blackish zone; showing also reddish touches. Plumage almost entirely blackish, with fleecy-white bases of feathers. Kas. to Tex., little known . . . . . *harlani* 515

Tail of adult *chestnut-red*, with broad black subterminal bar, and others or not; no reddish on wing-coverts; white prevailing on under parts, especially breast. Tail of young closely barred with grayish and blackish. Largest and most robust; wing usually 14.00 or more; tarsus stout. N. Am., abundant . . . . . *borealis* 516–519

Tail of adult *black*, crossed by about 6 white bars; primaries spotted with white; lesser wing-coverts reddish, like under parts. Tail of young dusky, numerously barred with whitish; under parts whitish, streaked with dusky. Less robust; wing usually under 14.00; tarsus slender. N. Am., abundant . . . . . *lineatus* 520, 521

Tail of adult *black*, with 3 broad white zones on inner webs only of the feathers, ashy on outer webs; plumage black, spotted or not with white. Tail of young dusky, inner webs mostly white, black-barred. Southwestern U. S. . . . . *abbreviatus* 522

Three outer primaries emarginate or sinuate on inner webs.

Tail numerously and narrowly cross-barred with lighter and darker. Plumage extremely variable, but not extensively reddish underneath, nor cheeks with a dark mustache. Large; wing usually over 13.00. Chiefly western U. S., abundant . . . . . *swainsoni* 523

Tail of adult blackish with about 3 light gray bands exposed; under parts extensively rufous; a dark moustache. Small; wing under 12.00. Eastern U. S., common . . . . *pennsylvanicus* 524

Tail (of adult ?) crossed with numerous light and dark bars (6–8 of each); general color fuliginous, scarcely or not varied. Southwestern U. S. . . . . *brachyurus* 882, 883

* Heavy-weights; 5 outer primaries cut.

512. B. unicin'ctus har'risi. (Lat. *uni-*, once; *cinctus*, girdled. To Edw. Harris.) HARRIS'S BUZZARD. Adult ♂ ♀: General plumage blackish, more or less intense, sometimes rather dark chocolate-brown, blackening on wings and tail, but in any case pretty uniform over the whole body. Lesser and part of middle wing-coverts, lining of wings, and the tibiæ, brownish-red, or rich chestnut. Tail-coverts and base of tail broadly white, thus girdling the whole figure; end of tail also white for an inch or more. Length of ♂ about 20.00; extent 41.00–46.00; wing 12.50–13.50; tail 8.50–9.50; tarsus 3.00-3.25; middle toe without claw 2.00. ♀ larger; about 23.00; extent 43.00–47.00; wing 13.50–14.50; tail 9.50–10.50. Young: Less decidedly blackish, the upper parts varied with rusty-brown, lower quite tawny with dusky spots or streaks, chestnut of wings not unbroken, and white of tail less distinctly defined. Tibiæ tawny-white, distinctly barred with chestnut. But in any plumage the species is unmistakable, forming a separate subgenus from *Buteo* proper, by some ranked as a genus; the loral region is extensively denuded to the eye, and furnished with short radiating bristles. In some respects it resembles *Polyborus*, being a sluggish, carrion-feeding bird, usually found associated with the caracara, turkey-buzzard, and black vulture. It is a common inhabitant of the warmer parts of America and over our Mexican border; abundant in some parts of Texas. Nest in a tree or bush; eggs commonly 2, measuring 2.00–2.10 × 1.70, white or whitish, unmarked or with faint brownish-yellow. (*Parabuteo Ridg. Erythrocnema* Sharpe.)

** Heavy-weights; 4 outer primaries cut.

513. B. albocauda'tus. (Lat. *albus*, white; *caudatus*, tailed.) WHITE-TAILED BUZZARD. Adult ♂ ♀: Tail and its coverts white, with a broad black subterminal zone, with numerous

very fine zig-zag or broken blackish cross-lines. Upper parts (excepting the rump, which is white like the tail), definitely including the sides of the head and neck, ash-color or plumbeous, lighter or darker in different cases, the feathers fleecy-white at bases so extensively as to show with the least disturbance of the plumage, and on the scapulars tinged with reddish. Most of the lesser wing-coverts (but not quite to the bend of the wing), chestnut, somewhat as in *B. unicinctus*. Entire under parts pure white, lightly touched with fine dusky cross-bars on the sides, lining of wings, and usually the tibiæ. On the surface of the wings the plumbeous of the upper parts deepens to the blackish of the primaries, whose inner webs are lighter and more brownish, crossed with numerous darker bars, and toward the base are cut, barred, or speckled with white, which increases in regularity, firmness, and extent on the secondaries. Shafts of wing-feathers brown or black, those of tail white along the white portion of the tail-feathers. Bill mostly dark, in part light; feet yellow; claws black. Length of ♂ 23.00; extent 48.00: wing 16.00; tail 7.00; chord of culmen, including cere, 1.40; tarsus about 3.25; feathered about 1.00 down in front. ♀ larger; length 24.00; extent 54.00; wing 17.50; tail 8.00, etc. (Described from Sennett's and Merrill's Texas specimens. Young unknown to me.) A fine large hawk of the warmer parts of America, lately ascertained to reach the Rio Grande of Texas; it is very unlike any other of this country.

514. **B. coo/peri?** (To Dr. J. G. Cooper.) COOPER'S BUZZARD = *Archibuteo ferrugineus?* "Head, neck, and whole lower parts white; feathers of the head and neck with medial longitudinal streaks of black, the white prevailing on the occiput and superciliary region, the black predominating over the cheeks, forming a "mustache;" throat with fine lanceolate blackish streaks; sides of the breast with broader, more cuneate markings of the same; flanks with narrow, lanceolate stripes, these extending sparsely across the abdomen; tibiæ and lower tail-coverts immaculate, the inner face of the former with faint specks. Upper plumage in general dark plumbeous-brown, inclining to black on the back; plumbeous clearest on primaries, which are uniformly of this color, the inner ones inclining to fine cinereous. Scapulars and wing-coverts spattered with white beneath the surface. Rump black; upper tail-coverts white, tinged with rufous, and with irregular, distant, transverse bars of blackish. Tail with light rufous prevailing, but this broken up by longitudinal daubs and washes of cinereous, and darker mottlings running longitudinally on both webs; basally, the ground-color approaches white; tips white, with a distinct but very irregular subterminal bar of black, into which the longitudinal mottlings melt; outer webs of lateral feathers entirely cinereous, and without the black band. Under side of the wing white, with a large black space on the lining near the edge; under surfaces of primaries white anterior to their emargination, finely mottled with ashy and with indistinct transverse bands terminally. 4th quill longest; 3d shorter than 5th; 2d equal to 6th; 1st equal to 10th. Wing 15.75; tail 9.10; tarsus 3.25; middle toe 1.70." Santa Clara Co., Cala., one specimen known, probably the last as well as the first; for I suppose this to be *Archibuteo ferrugineus* (with or without a *mésalliance* of *Buteo borealis*), with abnormally denuded tarsi. I have carefully examined the type specimen, but copy Mr. Ridgway's description in preference to constructing a new one.

515. **B. har/lani.** (To Dr. R. Harlan.) HARLAN'S BUZZARD. "BLACK WARRIOR." "Form strong and heavy, like *B. borealis*, but still more robust; tibial plumes unusually developed, long and loose, their ends reaching to or beyond the base of the toes; lateral toes nearly equal. Four outer primaries with inner webs cut. Wing 14.25–15.75; tail 8.80–10.00; culmen 1.00; tarsus 2.75–3.25; middle toe 1.50–1.70. Nearly uniform black, varying from a sooty to a carbonaceous tint, with more or less of concealed pure white. Adult: Tail confusedly mottled longitudinally with grayish, dusky, and white, often tinged or mixed with rufous, the different shades varying in relative amount in different individuals; a subterminal band of black. Young: Tail grayish-brown, crossed by about 9 very regular and sharply defined broad bands of black about equal in width to the gray ones." (Ridgway.) La. and Tex. to Kas.; an obscure

species, variously interpreted by writers. Different "black hawks" have been called "*harlani*," such as the melanistic phases of both *borealis* and *swainsoni*, and *harlani* has been supposed to be not different from *borealis*. A few specimens in the Smithsonian Institution, identified with Audubon's bird by Mr. Ridgway, agree sufficiently with the plate and description, and the alleged species may, for the present, stand upon its own demerits.

516. **B. borea/lis.** (Lat. *borealis*, northern. Fig. 380.) Red-tailed Buzzard. "Hen Hawk." Adult ♂ ♀ : Upper surface of tail rich chestnut, with white tip and usually a black subterminal zone, with or without other narrower and more or less imperfect black bars; sometimes barred throughout. From below, the tail appears pearly whitish with a reddish tinge, either quite uniform, or barred throughout with the whitish and blackish. In general, it is the ♀ with the most barred or completely barred tail, the ♂ with the uniform tail, only subterminally once-zoned. Upper parts blackish-brown, with a thoroughly indeterminate amount of light variegation, gray, fulvous, and whitish; feathers of hind head and nape with cottony white bases, showing when disturbed; those of hind neck usually with fulvous edging; of

Fig. 380. — Red-tailed Buzzard, nat. size. (Ad nat. del. E. C.)

scapular region showing most variegation with tawny or whitish, or both, the scapulars and adjoining feathers being largely barred, and only blackish on their exposed portions; upper tail-coverts showing much tawny and white. Ground color of under parts white, more or less buff-toned, the dark color of the upper parts reaching nearly or quite around the throat, the flanks and lower belly heavily marked with dark brown or blackish, but a large pectoral area, with the tibiæ and crissum, mostly free from markings, as a rule; but no description will cover the latitude of coloration. Primaries blackening on their exposed portions, for the rest lighter grayish-brown, dark-barred across both webs, and extensively white-areated on inner webs basally. Length of ♂ 19.00–22.00; extent about 48.00; wing 13.50–16.50; tail 8.50–10.00; tarsus 2.50–3.00, feathered half-way down in front. ♀ larger; length 21.00–24.00; extent about 56.00; wing 14.50–17.50; tail 9.50–10.00. ♂ ♀, young: General character of the upper parts the same as in the adult, but less variegated, and that chiefly with whitish and buff, instead of grayish and fulvous; upper tail-coverts more regularly barred with dark and white. Tail entirely different, without any shade of red; light gray, with numerous (6–10) regular dark bars, and narrow white tips; the gray gradually yields to the chestnut shade

with reduction, interruption, or extinction of all these bars except the last one. Under parts somewhat as in the adult, but, like the upper, without the fulvous or rufous shades; usually white, unmarked in a large pectoral area, with circlet of throat stripes, and pronounced abdominal zone of dark or blackish markings; tibiæ spotted or not; crissum immaculate. There should be no difficulty in recognizing this hawk among those of the Eastern U. S. in any plumage; the red tail of the adult is of course distinctive; a weakly young male might raise a doubt with reference to *B. lineatus;* in that case, notice the stout tarsi, feathered about halfway down; the decided white pectoral area, free from spots, circumscribed by dark markings, especially those of the abdominal zone; and absence of any reddishness on the upper parts or wing-coverts. Such is the ordinary "hen hawk" so abundant in Eastern North America, where it is subject to *comparatively* little variation. In the West, however, where it is equally numerous, it sports almost interminably in color, and not always conformably with geographical distribution. Several of these phases have received special names, as given beyond. I am willing to spread them upon my page, but too much of my life is behind me for me to spend much time in such trivial mutabilities. The tendency is to melanism and erythrism, the extreme case of which is *B. calurus* of Cassin. A pure *borealis*, exactly matching the normal Eastern type, is seldom seen in the West. But in all its color-variation, the bird preserves its specific characters of size and robust proportions, being thus readily distinguishable from the smaller and weaker species, *B. swainsoni*, in any of the endless and somewhat parallel variations of the latter. The nest is usually built high in a tree, a bulky mass of sticks and smaller twigs, mixed toward the centre with grass, moss, or other soft material, and often some feathers. Eggs generally 3, about 2.40×2.00, dull whitish, sometimes with only a few pale markings, oftener boldly and richly blotched with warm shades of brown. The young are slow to acquire their perfect plumage, being long full-grown before the red appears upon the tail, and this usually precedes the fulvous of the under parts.

517. B. b. calu'rus. (Gr. καλός, *kalos*, beautiful; οὐρά. *oura*, tail.) WESTERN RED-TAIL. BLACK RED-TAIL. The extreme case is chocolate-brown or even darker, quite unicolor, with rich red tail crossed by several black bars; from which erythro-melanism grading insensibly into ordinary *borealis*. The usual case is increase over *borealis* of dark rufous and dusky shades in bars and spots underneath, particularly on the flanks, flags, and crissum, and presence of other than the subterminal black bar on the tail. One case is chocolate-brown, with a great reddish blotch on the breast. Western N. Am. at large, particularly U. S. from R. Mts. to the Pacific.

518. B. b. lucasa'nus. (Of Cape St. Lucas.) ST. LUCAS RED-TAIL. A light-colored form, like *krideri*, white below, tinged with rufous on the tibiæ, and no black subterminal bar on the tail. Lower Cala.

519. B. b. kri'deri. (To John Krider.) KRIDER'S RED-TAIL. A light-colored form, pure white below, with few markings or none, and the subterminal tail-bar reduced or obliterated. High central plains, U. S. This and the last hardly tenable.

*** Light-weights; 4 outer primaries cut.

520. B. linea'tus. (Lat. *lineatus*, striped.) RED-SHOULDERED BUZZARD. WINTER HAWK. "CHICKEN HAWK." Adult ♂ ♀: Feet and cere chrome yellow, the anterior tarsal scales tinged with greenish. General plumage of a rich *fulvous* cast. Above, reddish-brown, the feathers with dark brown centres, giving the prevailing tone, and black shafts; head, neck, and entire under parts orange-brown, mostly with dark shaft-lines and white bars, especially on the lower parts posteriorly; lesser wing-coverts rich orange-brown or chestnut, forming a conspicuous area on the bend of the wing. Quills and tail-feathers black, beautifully marked with white; the primaries and secondaries with white spots or bars on both webs terminating on each edge of the feather, the light bars which cross the feather, and the darker intervening

spaces, being more or less touched with reddish. The same style of marking on the wing-coverts; the tail crossed with several narrow white bars, and the tip white. Young very different; little or no fulvous or orange-brown; above, plain dark brown, the wing-patch indicated or not; head, neck, and under parts white or buffy-white, fully streaked or arrow-headed with dark brown. Tail brown, crossed with many lighter and darker bars, the former mostly tawny on the outer webs, whitish on the inner webs; wing-quills extensively variegated in similar pattern. Length of ♂ 18.00–20.00; extent about 40.00; wing 11.50–13.50; tail 7.50–8.50; tarsus 2.75–3.25; ♀ 20.00–22.00; extent about 45.00; wing 12.00–14.00; tail 8.50–9.50. There is much variation in size; Florida and Gulf specimens are very small. Nearly as long as *B. borealis*, but not nearly so heavy; tarsi more extensively denuded. The adult of this handsome hawk is unmistakable; but the student may require to look closely after the young. Eastern N. Am., one of the commonest hawks of the U. S., especially in winter; not far N. in Brit. Am. Habits and nidification similar to those of *B. borealis*; eggs 2–4, 2.00–2.25 × about 1.75, with the usual range of color-variation.

521. B. l. elegans. (Lat. *elegans*, choice.) Western Red-shouldered Buzzard. The erythrism of the last. In extreme case, the whole under plumage rich dark reddish, almost obliterating the usual markings; wings and tail, however, still elegantly barred with pure white. R. Mts. to the Pacific, U. S.

522. B. abbrevia/tus. (Lat. *abbreviatus*, shortened.) Band-tailed Buzzard. Adult ♂ ♀: Coal-black, glossy and uniform over the whole body. Tail black; viewed above, it seems to be crossed with 3 zones of ashy-gray or slate-color, increasing in width and firmness from the proximal to the distal one, and is narrowly tipped with white; from below, there appear 3 pure white zones, since the ashy is on the outer webs only of the feathers (both webs of the middle pair, however), and the white is on the inner webs. The plumage of the head is snowy-white at the roots, and in some specimens, probably less mature, it is so extensive on the head, neck, and breast as to appear in spots on the least disturbance of the feathers. The wing-feathers appear quite black in the folded wing, but their inner webs basally acquire the usual light and dark spacing, with more or less whitish nebulation, or white areation. The feet appear to be yellow, the bill mostly dark. Young recognizably similar? Length of my Arizona specimen 19.50; extent 47.50; wing 15.50–16.50; tail 8.50–9.00; tarsus 2.50; middle toe without claw 1.60. A peculiar hawk, very unlike any other of the U. S., slightly built with long wings and tail; not yet well known nor worked out in all its plumages. Cent. Am. and Mex. into Southwestern U. S.; Ariz., Cala. (*B. zonocercus*, Scl., Tr. Z. S., 1858, pl. 59; Ridgw., Hist. N. A. B., iii, 1874, p. 272. *B. albonotatus*, Gray.)

**** Light-weights; 3 outer primaries cut.

523 B. swain/soni. (To Wm. Swainson.) Common American Buzzard. Swainson's Buzzard. Adult ♂ ♀: Upper parts dark brown, very variable in shade according to season or wear of the feathers, varied with paler brown, or even reddish-brown edgings of the feathers, but without the clear fawn-color of the young; the feathers of the crown showing whitish when disturbed, and usually sharp, dark shaft-lines; the upper tail-coverts chestnut and white, with blackish bars. Quills and tail-feathers as below, but the inner webs of the former showing more decided dark cross-bars upon a lighter marbled-whitish ground, and the latter having broader and sharper, dark wavy bars. These large quills, and particularly those of the tail, vary much in shade according to wear, the new feathers being strongly slate-colored, the old ones plain dark brown. The tail, however, never shows any trace of the rich chestnut that obtains in the adult *B. borealis*. Iris brown, never yellow; feet, cere, gape, and base of under mandible rich chrome-yellow; rest of bill and claws bluish-black. Adult ♂: Under parts showing a broad pectoral area of bright chestnut, usually with a glaucous cast, and sharp black shaft-lines; this area contrasting sharply with the pure white throat. Other under parts white,

more or less tinged and varied, in different specimens, with light chestnut. In some males, this chestnut is diminished to traces, chiefly in flank-bars and arrow-heads, and the white throat is immaculate; in others, the throat shows blackish pencilling, and the rest of the under parts are so much marked with chestnut, chiefly in cross-bars, that this color predominates over the white, and appears in direct continuation of the pectoral area itself. Some feathers of this area are commonly dark brown. Length 19.00–20.00; extent about 49.00; wing 15.00 or a little more; tail 8.50; tarsus 2.50; middle toe without claw 1.50. Adult ♀: Much darker underneath than the male; throat pure white, but other under parts probably never whitening decidedly. Pectoral area from rich dark chestnut or mahogany-color, mixed with still darker

FIG. 381. — *Buteo vulgaris* of Europe, $\frac{1}{6}$ nat. size; not distinguishable in the cut from one of the plumages of *B. swainsoni*. (From Brehm.)

feathers, to brownish-black; and other under parts heavily marked with chestnut, chiefly in cross-bars alternating with whitish, but on the flanks, and sometimes across the belly, these markings quite blackish. The general tone of the under parts may be quite as dark as the pectoral area of the male, but it lacks uniformity, and the increased depth of color of the pectoral area in this sex suffices to preserve the strong contrast already mentioned. Length 20.00–22.00; extent 50.00–54.00; wing 15.00–16.50; tail 9.00. Changes of plumage with age affect chiefly the under parts; the back, wings, and tail are more nearly alike at all times. Young ♂ ♀: Entire upper parts dark brown, everywhere varied with tawny edgings of the individual feathers. The younger the bird, the more marked is the variegation; it corresponds in tints closely with the color of the under parts, being palest in very young examples. Under parts, including lining of wings, nearly uniform fawn-color (pale dull yellowish-brown),

thickly and sharply marked with blackish-brown. These large dark spots, for the most part circular or guttiform, crowd across the forebreast, scatter on the middle belly, enlarge to cross-bars on the flanks, become broad arrow-heads on the lower belly and tibiæ, and are wanting on the throat, which is only marked with a sharp, narrow, blackish pencilling along the median line. Quills brownish-black, the outer webs with an ashy shade, the inner webs toward the base grayish, paler, and marbled with white, and also showing obscure dark cross-bars; their shafts black on top, nearly white underneath. Tail-feathers like the quills, but more decidedly shaded with ashy or slate-gray, and tipped with whitish; their numerous dark cross-bars show more plainly than those of the quills, but are not so evident as they are in the old birds. Nestlings are covered with white fluffy down. Western N. Am., Mississippi Valley to the Pacific, abundant; in many regions the commonest and most characteristic of the large hawks; occasionally eastward through the N. States to Canada and New England. Nests indifferently on the ground, cliffs, bushes, trees; nest indistinguishable from that of other large hawks; eggs usually 2, — I have never found more, sometimes only one; they are about 2.25 × 1.75, resembling hen's eggs, being nearly colorless and unmarked, like those of the marsh hawk; sometimes stained with rusty-brownish, probably never marked all over nor boldly blotched anywhere. This buzzard represents the European *B. vulgaris* (fig. 381) in N. Am., being, in fact, little different. (It is *Falco buteo* Aud., folio pl. 372; *B. vulgaris* Sw., F. B. A., pl. 27; Aud., 8vo, pl. 6; *B. montanus* Nutt., 1840, not of authors; *B. bairdi* Hoy (young); ? *B. oxypterus* Cass. young); *B. insignatus* Cass., Ill. pl. 31 (melanistic); *B. gutturalis* Maxim.; *B. obsoletus* Sharpe, 1874 (not *Falco obsoletus* Gm.). It is probably also *B.* "*vulgaris*" of Maynard, Bull. Nutt. Club, i, 1876, p. 2; and of Ridg., ibid. p. 32.)

524. B. pennsylva'nicus. (Lat. *pennsylvanicus*, of Wm. Penn's woods.) BROAD-WINGED BUZZARD. Adult ♂ ♀: Above, dark brown, the feathers with blackish shaft-lines, and pale grayish-brown or even lighter edgings, those of hind head and nape cottony-white basally; usually also some feathers with fulvous edgings, especially on the hind neck; upper tail-coverts barred or spotted with white. Primaries and secondaries blackish on outer webs and at ends, most of the inner webs white in large area, more or less perfectly barred with dusky; concealed parts of scapulars thus barred on both webs. Exposed portion of tail with three blackish zones, the terminal one broadest, alternating narrower pale gray or grayish-white zones, one of these terminal; from below these zones appear whitish, but from above grayish. Under parts mixed white and fulvous-brown, or dull chestnut, the latter nearly as pronounced as in *B. lineatus*, the pattern being rather that of *Accipiter fuscus* or *A. cooperi;* the fulvous in excess anteriorly, the white prevailing posteriorly and nearly or quite immaculate on crissum; the middle regions with the white in oval paired spots or incomplete bars on each feather, the flanks and tibiæ pretty regularly barred with the two colors; most of the feathers black-shafted, producing a fine pencilling, this black increasing to decided streaking on the white throat, and forming noticeable maxillary patches. Lining of wings mostly white, but with some reddish and blackish spotting. Bill mostly dark; feet yellow; claws black. Length of ♂ 14.00; extent 33.00; wing 10.50–11.00; tail 6.50–7.00; tarsus 2.30; middle toe without claw 1.20. ♀ larger; wing 11.00–11.50; tail 7.00–7.50. Young: Differs as usual in the genus, in lacking the special coloration and pattern of the under parts, tail-pattern different, wing-pattern much the same. Upper parts blackish-brown, highly variegated with fulvous, tawny, or whitish edgings of all the feathers, on the head and neck the light and dark colors in streaks about balancing each other. Under parts white, more or less buff-toned, with more or fewer linear or clubbed fuscous markings on the breast and sides, changing to arrow-heads on the flanks and sides, the amount of this marking wholly indeterminate. Tail crossed with numerous light and dark bars (six or eight of each exposed), on both webs of middle feathers and outer webs of the others; these on their inner webs largely white, with consequently better pronounced dark bars; all the feathers tipped with white. Eastern N. Am. and throughout Middle America, common;

a small but stout *Buteo*, with ample wings and tail, very different from any of the foregoing, and easily recognized by its size and proportions, aside from color. A large ♀ resembles a small ♂ *B. lineatus* in some respects, but the difference is too great to require detailed comparison. Nesting nowise peculiar; eggs 3–5, 2.00 × 1.60, heavily marked.

882, 883. B. brachyu'rus. (Gr. *βραχύς, brachus*, short; *οὐρά, oura*, tail.). FULIGINOUS BUZZARD. Resembling *B. abbreviatus* in being blackish or fuliginous all over, but entirely another bird, belonging to a different section of the genus. Only three primaries are abruptly emarginate on the inner web, though the next one is sinuate. Adult ♀? Color fuliginous, or dark umber-brown, nearly uniform, but barred on the under wing- and tail-coverts with white, and the feathers of the hind head and nape fleecy-white at base; the color blackening on the exposed surfaces of the primaries, the inner webs of which are extensively whitened, with the usual dark bars; little white, however, on the secondaries, excepting the inner ones, most of them being simply spaced gray or light brown between their dark bars. Tail-pattern as usual in *young* hawks of this genus, there being numerous (6 or 8 exposed) blackish and lighter grayish bars alternating, the subterminal one of each broadest, the whole tail tipped with grayish-white; the inner webs of all the feathers excepting the central pair whitening in the spaces between the dark bars. Length 16.00; wing 13.00; tail 7.00; tarsus 2.00. (Described from No. 12,117, Mus. Smiths. Inst., from Mazatlan, Mex., agreeing with *B. fuliginosus* Scl., P. Z. S., 1858, p. 356; Tr. Z. S., 1858, p. 267, pl. lxii; a bird supposed to be the *young* of the same is *B. oxypterus*, Cass., Pr. Phila. Acad., 1855, p. 283; both are treated as a variety of *B. swainsoni* by Ridgway, Hist. N. A. B., iii, 1874, p. 266; but are now supposed to be melanistic adult, and young, of a good species, probably *B. brachyurus* Vieill., which normally has the face and most under parts white.) Mexican border, Florida, and southward.

181. ARCHIBU'TEO. (Lat. *archi-*, from Gr. *ἀρχός, archos*, a leader, chief; *buteo*, a buzzard.) HARE-FOOTED BUZZARDS. Chars. of *Buteo* proper, but tarsi feathered in front to the toes, naked and reticulate along a strip behind. Wings very long; 3d and 4th quills longest; 1st shorter than 7th; 4 or 5 emarginate on inner webs. A small group, well marked by the character of the feet. The species are among the largest of the buzzard-hawks, but are rather dull heavy birds, preying upon humble quarry, especially small quadrupeds, reptiles, and insects.

Analysis of Species

Below, white, variously dark-marked, and often with a broad black abdominal zone, but generally no ferruginous; in melanotic state, whole plumage nearly uniform blackish. . *lagopus sancti-johannis* 525

Below, pure white, scarcely or not marked, excepting that the legs are rich rufous with black bars, in marked contrast; above, varied with dark brown, chestnut and white; quills brown, with much white; tail silvery-ash and white, clouded with brown or rufous . . . . . *ferrugineus* 526

525. A. lago'pus sancti-johan'nis. (Gr. *λαγώπους, lagopous*, hare-footed; Lat. *sancti-johannis*, of St. John, Newfoundland. Fig. 382.) AMERICAN ROUGH-LEGGED BUZZARD. "BLACK HAWK." Adult ♂ ♀: Too variable in plumage to be concisely described. In general, the whole plumage with dark brown or blackish and light brown, gray, or whitish, the lighter colors edging or barring the individual feathers; tendency to excess of the whitish on the head, and to the formation of a dark abdominal zone or area which may or may not include the tibiæ; usually a blackish anteorbital and maxillary area. Lining of wings extensively blackish. Tail usually white from the base for some distance, then with dark and light barring. The inner webs of the flight-feathers extensively white from the base, usually with little if any of the dark barring so prevalent among buteonine hawks. From such a light and variegated plumage as this, the bird varies to more or less nearly uniform blackish, in which case the tail is usually barred several times with white. Our lighter-colored birds are not fairly separable from the normal European *A. lagopus*; but our birds average darker, and their frequent melanism does not appear to befall the European stock. But in any plumage the rough-leg is known at a glance from any *Buteo* by the feathered shanks; while the peculiar coloration of

A. ferrugineus is highly distinctive of the latter. Length of a ♀, 22.00; extent 54.00; wing 17.50; tail 9.00; iris light brown; bill mostly blackish-blue, cere pale greenish-yellow, feet dull yellow, claws blue-black. This is about an average size; the ♂ averages smaller; wing about 16.00, etc. The name adopted, it must be observed, is not intended to discriminate the black from the ordinary plumage, but to separate the American bird subspecifically from the European. N. Am., at large, common, especially in fertile, well-watered regions, as those of

FIG. 382. — Rough-legged Buzzard, $\frac{1}{6}$ nat. size. (From Brehm.)

the Atlantic seaboard; a large, heavy, and somewhat sluggish hawk, haunting meadows and marshes, to some extent crepuscular in habits, of low, easy, and almost noiseless flight; preying upon insignificant quarry, particularly small rodent and insectivorous mammals, reptiles, batrachians and insects. Nest usually in large trees, but frequently on a ledge of rocks or the edge of a cut-bank; a bulky mass of interlaced sticks, with softer matted material of miscellaneous kinds; eggs 3–5, laid late in May and in June, measuring 2.10–2 25 in length, by 1.75–1.80 in breadth; varying in color from dingy whitish with scarcely any marking, or but

faint clouding, to creamy-white boldly variegated with blotches and washes of dark brown on the surface, with neutral-tint markings in the substance of the shell.

526. A. ferrugi'neus. (Lat. *ferrugo*, iron-rust.) FERRUGINOUS ROUGH-LEGGED BUZZARD. "CALIFORNIA SQUIRREL HAWK." Adult ♂ ♀: Below, pure white from bill to end of tail, the legs rich rufous or bright chestnut barred with black, in marked contrast; usually a few chestnut bars or arrow-heads on the belly and flanks, and the breast with sharp shaft lines of black. The older the bird the purer white below, with more perfect contrast of the chestnut legs; the ♀ retaining marks of immaturity longer than the ♂; these consisting in extension of the black-barred chestnut markings on to the belly, flanks, and even more of the under parts, and spreading of the fine shaft lines on the breast into ordinary streaks. Tail silvery-white below, above white at base and extreme tip, in most of its extent clouded with silvery-ash and more or less tinged with ferruginous. Back, rump, and wing-coverts mixed blackish and bright chestnut in varying but about equal amounts, the former color making central markings on the exposed portion of each feather, the chestnut yielding to white at the bases of the feathers. Top, back, and sides of head streaked with blackish and white in about equal amounts, the feathers being cottony-white, with dark streaks or spaces on their exposed portions. Primaries blackish, with a glaucous bloom on their outer webs, their shafts almost entirely white, several outer ones with extensive pure white areation on their inner webs; inner primaries and secondaries continuing this pattern, but with more or less evident ashy spacing between blackish bars, as usual in buteonine hawks. Length of ♂, 22.50; extent 54.-50; wing 16.75; tail 9.25; tarsus 2.75; length of ♀, 23.50; extent 56.50; wing 17.25; tail 9.75. Iris pale brownish to light yellow; cere and feet bright yellow; bill dark bluish horn-color; mouth purplish flesh-color. Third and 4th quills subequal and longest; 2d between 5th and 6th; 1st about equal to 8th; 1st–4th abruptly emarginate on inner webs; 2d–5th sinuate on outer webs. The foregoing is from a fine pair I procured in Arizona in 1864. A younger bird is described as less rufous above, and almost entirely white below, the flags scarcely variegated or contrasted. The first plumage does not seem to be described; I have seen it in Dakota, but have no specimen at hand, and cannot trust my memory. One of the largest, handsomest and most distinctively marked hawks of N. Am., somewhat recalling *Buteo albocaudatus;* common in the west, from the region of the Red River of the North and of the Saskatchewan to Texas and into Mexico, and from the Plains to the Pacific; sometimes even E. of the Mississippi, as in Iowa. Nesting and habits in no wise peculiar, as compared with those of other large hawks; nest in trees, on ledges and banks, composed of sticks, with matted lining of various softer materials; eggs not characteristic, but large, averaging 2.50 × 1.95.

182. ASTURI'NA. (Modified from Lat. *astur*, a hawk.) STAR BUZZARDS. General chars. of *Buteo*, in proportions, but system of coloration as in *Astur:* sexes alike; adults ashy, with black, white-barred tail, the under parts closely barred crosswise with ashy and white; young different, the under parts marked lengthwise with blackish on a whitish ground. Wings short for this subfamily; 3d, 4th, and 5th quills longest, 1st very short; outer 4 emarginate on inner webs; 2d–5th cut on outer webs. Tail even, long, about ¾ the wing. Legs longer than usual in *Buteoninæ*, more nearly as in *Accipitrinæ;* feet stout; tarsus scutellate before and half-way up behind, shortly feathered above in front, elsewhere strongly reticulate. A small group of handsome under-sized hawks, peculiar to America.

527. A. plaga'ta. (Lat. *plagata*, striped.) GRAY STAR BUZZARD. Adult ♂ ♀: Upper parts nearly uniform cinereous, or light plumbeous, the feathers dark-shafted, and with nearly obsolete undulations of lighter ash; upper tail-coverts in part white. Tail black, with several white zones, sometimes broken, and white or whitish tip. Under parts, including tibiæ, white, beautifully and closely cross-barred with dark ash, except upon the throat and crissum; some of the feathers also dark-shafted. Lining of wings white, less closely barred with ashy. Primaries darkening from the color of the back, their inner webs spaced lighter and darker, and

with extensive white areation, which characters increase on the secondaries. Iris brown; cere and feet bright yellow; bill and claws blue-black. Wing of ♂ 10.00; tail 7.00; tarsus 2.75; middle toe without claw 1.50. Wing of ♀ 11.00; tail 8.00. Young: Blackish-brown above, much variegated with reddish-buff, the white upper tail-coverts spotted with blackish; below, whitish, dashed with large blackish marks, the flags barred; tail dark brown, with numerous narrow blackish bars. Cent. Am. and Mex., regularly into southwestern U. S., occasionally up the Mississippi Valley to Illinois. Nest in trees or bushes, not peculiar; eggs 2, round-oval, colorless, 2.00 × 1.60.

183. URUBITIN'GA. (S. Am. *urubu*, a vulture; *tinga*, bright.) ANTHRACITE BUZZARDS. General chars. of *Buteo*, but system of coloration peculiar, the adults being chiefly black and white, the tail typically broadly zoned. The limits of the genus vary with different writers: it contains several species, confined to America, one of them reaching our border. In this the tail is about ⅔ as long as the wing, emarginate or nearly even; the wing with 3d–5th quills longest, 2d about equal to 6th, 1st very short; outer 4 sinuate on inner webs; the point of the folded wing reaching but little beyond the longest secondaries; the bill lengthened and rather weak; the tomia of the upper mandible strongly festooned or almost lobated back of the hook; gonys convex; nostrils large, subcircular; lores extensively denuded; tarsus much longer than middle toe and claw, feathered but a little way down in front, scutellate before and behind, reticulated laterally like the basis of the toes, which in the rest of their length are broadly scutellate.

528. U. anthraci'na. (Lat. *anthracinus*, carbuncular; in this case coal-black.) ANTHRACITE BUZZARD. Adult ♂ ♀: Coal-black; feathers of head and neck with concealed white bases; tail white at extreme base and tip, and crossed about the middle with a broad white zone; ends of coverts white; quills of wing more or less mottled with rusty-brown; cere, rictus, and base of bill, and feet, yellow; bill and claws blackish. Length about 23.00; wing 13.00–15.00; tail 8.00–10.00; tarsus 3.25; ♀ larger than ♂. Young: Extensively varied with rusty or buff, which is gradually obliterated as the bird matures; tail numerously barred with black and white. There are 6–9 such bars, mostly broken or otherwise irregular. The whole under parts are white, more or less tinged with buff, pencilled on the throat, heavily striped on the breast and sides, closely barred across on the tibiæ and crissum, with blackish. The feathers of the head, nape, and foreback are largely white or whitish, appearing in streaks among the overlying blackish of the ends of the feathers. The exposed portions of the primaries are blackish, obsoletely crossed with lighter; these feathers lightening basally and internally, where narrow blackish bars alternate with wider spaces of white tinged with brown and fulvous. The secondaries and larger coverts are brown with narrow dark bars, their inner webs also indented with whitish and tawny. The younger the bird the more the whitish or buff prevails over the dark colors. The contrast between the cross-barred tibiæ and the lengthwise-striped breast and sides is always notable. The tail varies from rounded through square to emarginate. A remarkable hawk of Cent. Am., W. I., and Mex., lately ascertained to occur in Arizona.

184. ONY'CHOTES. (Gr. ὄνυξ, ὄνυχος, *onux*, *onuchos*, a claw, and a suffix *-της*, *-tes*.) CLAWED BUZZARD. "Bill short, the tip remarkably short and obtuse, and only gradually bent; cere on top about equal to culmen; very broad basally in its transverse diameter, and ascending in its lateral outline, on a line with the culmen; commissure only faintly lobed. Nostril nearly circular, with a conspicuous (but not central or bony) tubercle; cere densely bristled below the nostril, almost to its anterior edge; orbital region finely bristled. Tarsus very long and slender, nearly twice the length of the middle toe; toes moderate, the outer one decidedly shorter than the inner; claws very long, strong, and sharp, curved in about one-quarter the circumference of a circle. Tibial feathers very short and close, the plumes scarcely reaching below the joint. Feathers of the forehead, gular region, sides and tibiæ with white filamentous attachments to the ends of the shafts. Wing very short, much rounded, and very concave beneath;

4th quill longest; 1st shorter than 9th; 4 primaries emarginated, and one sinuated, on inner webs; 5 sinuated on outer webs. Tail about ⅔ as long as wing, rounded. Outstretched feet reaching beyond end of tail." (Ridgway.) One species.

529. **O. gru'beri.** (To F. Gruber.) GRUBER'S BUZZARD. "Immature? General plumage dull dark bistre, with a grayish-umber cast in some lights, darkest on the head above and back; the posterior lower parts paler and more reddish; throat and neck much tinged with pale rusty; primaries uniform black. Tail like the rump, but with a more hoary tinge, not paler at the tip, and crossed with 7 or 8 very narrow obscure bars of darker, the last of which is distant an inch or more from the end. Lining of wings dark bistre, much tinged with rusty, this prevalent toward the edge; under surfaces of primaries white anterior to their emargination, beyond which they are ashy, approaching black at the ends; ashy portion with distant, very obsolete, dusky bars, but the cheeks and throat streaked obsoletely with this color. No distinct white anywhere about head or neck. Wing 10.00; tail 5.80; tarsus 2.70; middle toe 1.40." (Ridgway.) California? A second specimen has been discovered since the description here copied was made. "Closely allied to, if not identical with, *Urubitinga*." (Sharpe.)

185. **THRASYAË'TUS.** (Gr. *θρασύς, thrasus*, bold; *ἀετός, aëtos*, an eagle.) HARPY EAGLES. A genus containing one species of enormous size, the most powerful raptorial bird of America, if not of the entire sub-order. Head with a broad flowing occipital crest. Bill of great length and depth, much compressed, so hooked that the curve of the culmen is about a quadrant of a circle, the commissure about straight, the tomia festooned but not toothed; cere extensive, with nearly vertical fore-edge, close to which are the narrowly oval nostrils about midway between tomia and culmen; lores extensively naked and bristly; superciliary shield prominent; feet and talons of immense strength; tarsus feathered a little way down in front; the covering of the feet reticulate, excepting a few scales on top of the toes; lateral toes much shorter than middle one; inner claw much larger than middle one; hinder one much the largest of all. Wings rather short, but very ample, the secondaries entirely covering the primaries when folded; wing as a whole much vaulted, the outer quills strongly bowed. Tail long, ¾ the wing, fan-shaped, vaulted.

531. **T. harpyi'a.** (Gr. *ἅρπυια, harpuia*, a harpy.) HARPY EAGLE. The largest and finest specimen before me I judge to have been nearly or about 4 feet long; the wing is about 2 feet; the tail 18 inches; chord of culmen, including cere, 2.75 inches; depth of bill 1.50; tarsus over 4.00; chord of hind claw nearly 3.00. Head and entire under parts dull white, more or less obscured with ashy or dusky, particularly on the crest, across the throat, and on the tibiæ, which latter are in some cases regularly barred with blackish. Upper parts at large ashy-gray, intimately but irregularly barred with glossy black, especially on the wing-coverts. Flight-feathers mostly blackish, but with more or less ashy nebulation, to which whitish variegation is added on the inner webs. Tail pretty regularly barred with black and ash, in other cases irregularly nebulated with light and dark ash. The bill appears to have been blackish, the feet of some yellowish color. Young birds are much darker. C. and S. Am. and Mexico, a well known and most formidable bird of prey, reaching the Texas border.

186. **A'QUILA.** (Lat. *aquila*, an eagle.) GOLDEN EAGLES. Birds of great size, robust form and powerful physique, but in technical characters near *Buteo* and especially *Archibuteo*. Tibia extensively flagged. Tarsus closely feathered all around to the toes; toes mostly reticulate on top, margined, outer and middle webbed at base. Bill large, long, very robust; tomia lobed; nostrils oval, oblique; superciliary shield prominent. Wings long, pointed by the 3d–5th quills, 2d subequal to 6th, 1st very short, 5 or 6 emarginate on inner webs; 2d to 6th or 7th sinuate on outer webs. Tail moderate, rounded or graduated. Feathers of occiput and nape lanceolate, acute, discrete, like a raven's throat-plumes. Sexes alike; changes of plumage not great. This extensive genus includes the eagles properly so called, of which there are numerous Old World species, but only one American.

532 **A. chrysaë'tus.** (Gr. χρυσάετος, *chrusaëtos*, golden eagle. Fig. 383.) GOLDEN EAGLE. RING-TAILED EAGLE. Adult ♂ ♀ : Dark brown, with a purplish gloss, lighter on the coverts of the wings and tail and on the flags or tarsi; the cowl of lanceolate feathers golden-brown. Quills and tail-feathers blackish, but basally more or less variegated or areated with light brown, gray, or whitish; at maturity these markings becoming extensive and definite. Young birds are blacker than the adults, which "grow gray" with age, and are "ring-tailed," that is, the basal portion and finally most of the tail is white, offset by a broad black terminal zone. Length about 3 feet; extent 6 feet or more: wing 2 feet (♂) or more (♀); tail 14.00–15.00 inches (♂) or more (♀); bill, without cere, 1.50–1.75; tarsus 3.50–4.00. This great bird inhabits N. Am. at large, as well as Europe, Asia, etc.; in this country rather northerly, S. ordinarily to about 35°. The American is not fairly to be distinguished from the European, but on the whole is a larger and "better" bird, like several others of the present family, as well as of the goose and duck tribes. This I suppose to be owing to the fact that there is more room for them, more food, less persecution, and altogether less competition in the struggle for existence. It breeds chiefly in mountainous or boreal regions, the eyrie being usually upon a crag, the nest an enormous platform of sticks, etc. The eggs are subspherical and equal-ended; four selected specimens measure: 2.65 × 2.15; 2.90 × 2.40; 3.00 × 2.35; 3.10 × 2.25; in 12 cases, only one is white like a bald eagle's; the rest are whitish, wholly indeterminately spotted, splashed and smirched with rich sienna, umber and bistre browns, with neutral-tint shell-markings; 2, 3, or 4 are laid.

FIG. 383. — The Eyrie of the Golden Eagle. (Designed by H. W. Elliott.)

187. **HALIAË'TUS.** (Gr. ἁλιάετος, *haliaëtos*, a sea-eagle; *i. e.*, the osprey.) SEA EAGLES. FISHING EAGLES. General chars. of *Aquila*, as above, but the tarsi only feathered about half-way down, and no webbing between outer and middle toes. This nakedness of the shank is an infallible character: among the several different kinds of eagles popularly attributed to North America, only *two* have been found on the continent; the one with the feathered shank is No. 532; the one with scaly shank is No. 534, whatever its size or color. The scutellation of the

tarsus varies in this species; there is normally a short row of scales in front, discontinued about the bases of the toes, where are granular reticulations, the scutellation being resumed further on the toes. Wings pointed by 3d–5th quills; 2d nearly equal to 6th: 1st longer than 9th; 5 to 6 emarginate on inner webs. Tail rounded, graduated or cuneate, of 12 rectrices (14 in the Asiatic *H. pelagicus*). Feathers of neck all around lance-acute, discrete. About 8 species of this genus are recognized; one of them is appropriate to this continent; another occurs in Greenland; a third (*H. pelagicus*) may be expected in Alaska.

Analysis of Species.

Adult with head and tail white . . . . . *leucocephalus* 534
Adult with tail only white . . . . . *albicilla* 533

533. H. albicil'la. (Lat. *albicilla*, white-tailed.) WHITE-TAILED SEA EAGLE. Adult ♂ ♀: Dark brown, blackening on primaries, the head and neck gray, the tail white. Bill and feet

FIG. 384. — Bald Eagle. (From Tenney, after Wilson.)

yellow. Young with tail not white, and otherwise different. Rather larger than the next species. Europe, etc., only North American as occurring in Greenland.

534. H. leucoceph'alus. (Gr. λευκός, *leucos*, white; κεφαλή, *kephale*, head. Fig. 384.) WHITE-HEADED SEA EAGLE. "BALD EAGLE." "BIRD OF WASHINGTON" (the young). Adult: ♂ ♀: Dark brown; quills black; head and tail white; bill, eyes, and feet yellow. Length about 3 feet; extent 6 or 7 feet; wing 2 feet (♀) or less (♂); tail a foot, more (♀) or less (♂). Three years are required for the perfection of the white head and tail of the "bald" eagle. The first year, the young are "black" eagles; very dark colored, with fleecy white bases of the feathers showing here and there; bill black; iris brown; feet yellow. The next year, they are "gray" eagles, and usually larger than the old birds, the largest known specimens being of this kind. Young in the down are sooty-gray. N. Am. anywhere, common — for an eagle; piscivorous; a piratical parasite of the osprey: otherwise notorious as the emblem of the republic. Nest on trees or cliffs; eggs ordinarily 2, white, unmarked, about 3.00×2.50.

32. Family PANDIONIDÆ: Fish Hawks; Ospreys.

FIG. 385. — The Fish Hawk, or Osprey. (After J. Wolf.)

See page 498. Plumage peculiar, close and firm, imbricated, oily, lacking aftershafts; head densely feathered up to the eyes; occipital feathers lengthened; legs closely feathered, without any sign of a flag; quills of the wings and tail acuminate, stiff and hard, and the primary coverts of similar character. Feet immensely large and strong, roughly granular-reticulate; tarsi little feathered above in front; toes all free to the base, the outer versatile. Claws very large, all of equal lengths, subcylindric or tapering terete, not being scooped out underneath, but all compressed, and the middle one sharply grooved on the inner face. Bill toothless, contracted at the cere, elsewhere inflated, with very large hook; gonys convex, ascending; nostrils oval, oblique, without tubercle, and in the edge of the cere. The peculiarities of the plumage and of the feet are in evident adaptation to the semi-aquatic piscivorous habits of these "fishing hawks," which require a water-proof covering, and great talons to grasp their slippery quarry. The structural characters are rather those of the buteonine than the falconine birds of prey, in the coracoid arrangement, etc.. The supraorbital shield is rudimentary, leaving the eye flush with the side of the head. The family consists of a single genus, and probably but one cosmopolitan species, the well-known Osprey, *Pandion haliaëtus*.

88 **PANDI'ON.** (Gr. Πανδίων, Lat. *Pandion*, nom. propr. Fig. 385.) OSPREYS. To the foregoing add: Wings very long, pointed; 2d and 3d primaries longest; 1st between 3d and 5th; 3 outer ones abruptly emarginate on inner webs, and 2d to 4th sinuate on outer webs. Tail short, scarcely or not half as long as the wing. Sexes alike; ♀ larger. Young similar.

›30. **P. haliaë'tus.** (See *Haliaëtus*.) FISH HAWK. OSPREY. Adult ♂ ♀: Above, dark vandyke-brown, blackening on the quills, the feathers of the upper parts more or less completely edged with white — the older the bird, the more conspicuous the white markings. Tail dark brown with dusky bars, white tip and shafts, and inner webs of all but the middle pair of feathers regularly barred with white and dark. Head, neck, and under parts white, the crown more or less extensively streaked with blackish, and a heavy blackish postocular stripe to the nape: the breast more or less spotted with dusky brown; the white more or less tinged with tawny in some places, especially under the wings and on the head. Coloration very variable in the relative

amounts of the dark and white colors; young darker, the upper parts without the white crescents. Bill blackish, bluing at base and on cere; feet grayish-blue; claws black; iris yellow or red. Length 2 feet or rather less; extent about 4½ feet; wing 17.50–21.50; tail 8.50–10.50; tarsus 2.25; middle toe without claw 1.75; chord of culmen without cere 1.30; chord of claws nearly the same. Nearly cosmopolitan; entire temperate N. Am., over inland waters and especially along the sea-coasts, migratory, abundant. Few birds are better known than this industrious fisherman, so often the purveyor perforce of the bald eagle. Breeds anywhere in its range; nest bulky, finally acquiring enormous dimensions by yearly repairs and additions, placed usually in a tree or stout bush, sometimes on rocks or the ground; sometimes hundreds together. Eggs usually laid in May, 2 or 3 in number, very variable in size, say 2.50×1.75, running through all the variations in color common to hawks' eggs, from a white to creamy, tawny or reddish ground, from few brownish markings to heaviest blotching with sienna, umber, bistre and sepia; coloration usually richly reddish or mahogany. Some nests grow to be 6 or 8 feet in diameter, and as much in depth, and smaller birds, such as purple grackles, frequently build theirs in the interstices of the mass.

8. Suborder CATHARTIDES: American Vultures.

As already stated (page 497), the characters of this group are of more than family value, for which I lately proposed the above name (New England Bird Life, vol. ii, p. 135). In no event have these birds anything to do with the Old World vultures, which scarcely form a subfamily apart from *Falconidæ*. In a certain sense, they represent the gallinaceous type of structure; our species of *Cathartes*, for instance, bears a curious superficial resemblance to a turkey. They lack the strength and spirit of typical *Raptores*, and rarely attack animals capable of offering resistance; they are voracious and indiscriminate gormandizers of carrion and animal refuse of all sorts — efficient and almost indispensable scavengers in the warm countries where they abound. They are uncleanly in their mode of feeding; the nature of their food renders them ill-scented, and when disturbed they eject the fœtid contents of the crop. Although not truly gregarious, they assemble in multitudes where food is plenty, and some species breed in communities. When gorged, they appear heavy and indisposed to exertion, usually passing the period of digestion motionless, in a listless attitude, with the wings half-spread. But they spend much of the time on wing, circling high in the air; their flight is easy and graceful in the extreme, and capable of being indefinitely protracted. On the ground, they habitually walk instead of progressing by leaps. Possessing no vocal apparatus, these vultures are almost mute, emitting only a weak hissing sound.

33. Family CATHARTIDÆ: American Vultures.

See page 497. Head, and part of the neck, more or less completely bare of feathers, sometimes caruncular; eyes flush with the side of the head, not overshadowed by a superciliary shield; ears small and simple. Bill lengthened, contracted toward the base, moderately hooked and comparatively weak. Nostrils very large, completely perforated, through lack of a bony septum. Wings very long, ample, and strong; tail moderate. Anterior toes long for this order, webbed at base; hind toe elevated, very short; claws comparatively lengthened, obtuse, little curved and weak. To these external characters, which distinguish our vultures, I may add, that there are numerous osteological peculiarities. A lower larynx is not developed. The capacious gullet dilates into an immense crop. Cœca are wanting. The carotids are double. The feathers lack an aftershaft; the plumage is sombre and unvaried; its changes are slight; the sexes are alike, and the ♀ is not larger than the ♂. The famous Condor of the Andes, *Sarcorhamphus gryphus*; the King Vulture, *Gyparchus papa*, which probably occurs in Arizona, and species of the three following genera, compose the family.

Analysis of Genera.

Head and neck entirely naked; tail square	*Pseudogryphus* 189
Head and upper part of neck naked; tail rounded	*Cathartes* 190
Head naked, but feathers running up to it behind; tail square	*Catharista* 191

189. **Pseudogry'phus.** (Gr. ψεῦδος, *pseudos*, false; Lat. *gryphus*, a griffin.) CALIFORNIAN CONDOR. Size immense, about equalling that of the Condor. Head and neck entirely bare, smooth, without caruncular appendages. No cervical ruff of snowy, downy feathers; plumage beginning over the shoulders with loose lance-linear feathers, and that of the under parts generally of similar character. Frontal region depressed below the level of the inflated cere, but the general profile straightish from the hook of the bill to the hind head. Bill wide and deep, comparatively little hooked. Nasal passage much more contracted than the nasal fossa. Wings of great amplitude, folding to or beyond the end of the square tail, the ends of the primaries uncovered by the secondaries; 4th or 5th quills longest. Tarsus about as long as middle toe. One species.

FIG. 386. — Californian Condor. (From Tenney, after Audubon.)

536. **P. californianus.** (Of California. Fig. 386.) CALIFORNIAN CONDOR. Adult ♂ ♀: Blackish, the feathers with browner tips or edges, quite gray or even whitish on the wing-coverts and inner quills; primaries and tail-feathers black; axillars and lining of wings white; bill yellowish, reddening on cere, and skin of the head orange or reddish; iris said by some to be brown, by others carmine. Length 4–4½ feet; extent about 9½ feet; wing 2½–3 feet; tail 1¼–1½ feet; tarsus 4.50–5.00 inches; middle toe without claw 4.00–4.50; middle claw 1.90; hind claw 1.50; chord of culmen without cere about 1.50, but whole bill about 4.00, whole head about 7.00; cere on top nearly 3.00. Young with the bill and naked parts dusky, and more or less downy; plumage without white. Nestlings covered with whitish down. Pacific coast region, U. S. and southward, common. This great creature rivals the condor in size, and like it is powerful enough to destroy young or otherwise helpless animals, though its usual food is carrion. The nidification, as described, is like that of the turkey buzzard; but the eggs are whitish, unmarked. They measure about 4.50×2.50. The general habits appear to be the same as those of the turkey buzzard; the flight is similar.

190. **CATHAR'TES.** (Gr. καθαρτής, *kathartes*, a purifier.) TURKEY BUZZARDS. Of medium size; body slender. Whole head and upper part of neck naked, the plumage beginning as a

circlet of ordinary feathers all around the neck; the naked skin corrugated and sparsely beset with bristles, especially a patch before the eye. Bill long, moderately stout and hooked, the nostrils large, elliptical, completely pervious, the cere contracted opposite them. Wings extremely long, not particularly broad, pointed, folding beyond the tail, which is short and rounded. Point of the wing formed by 3d or 4th quill; 2d and 5th nearly as long; 1st much shorter; outer 4 or 5 emarginate on inner webs. Tarsus about as long as middle toe without claw. Of *Cathartes* as restricted there are several species described, but only one is established as N. Am. They are noted for their extraordinary powers of sailing flight.

537. **C. au'ra.** (Vox barb., name of the bird. Fig. 387.) TURKEY BUZZARD. Adult ♂ ♀:

FIG. 387. — Turkey Buzzard, ⅛ nat. size. (From Brehm.)

Blackish-brown, grayer on the wing-coverts; quills black, ashy-gray on their under surface; tail black, with pale brown shafts. Head red, from livid crimson to pale carmine, with whitish specks usually; bill dead white; feet flesh-colored; iris brown. Length 2¼-2½ feet; extent about 6 feet; wing 2 feet or less; tail a foot or less; tarsus 2.25 inches; middle toe without claw rather more; outer toe 1.50; inner 1.25; hind 0.75; chord of culmen without cere 1.00. Weight 4–5 pounds. Young darker than the adults; bill and skin of head dark, the latter downy. Nestlings covered with whitish down. U. S. and adjoining provinces, Atlantic to Pacific, and south clear through C. and S. Am.; N. to about 53°; resident N. to about 40°, beyond which migratory, being starved out in winter. Nests on the ground, or near it in hollow stumps or logs, generally in communities. Eggs commonly 2, sometimes 1, about

2.75 × 1.90, white or creamy, variously spotted and blotched with different browns, and with lavender or purplish-drab shell-markings. This species has a curious habit of "playing possum," by simulating death when wounded and captured; the feint is admirably executed and often long protracted.

191. CATHARISTA. (Gr. καθαρίζω, *katharizo*, I purify.) Carrion Crows. Of medium size; body stout. Head naked, and generally as in *Cathartes*, but feathers of the neck running up behind to a point on the occiput, the outline of the plumage thus very different. Cere contracted; nostrils narrow, less openly pervious than in *Cathartes*. Wings shorter and relatively broader than in *Cathartes*, not folding to the end of the tail, which is short, only about half the wing, and even or emarginate; 4th and 5th quills longest. The difference in size and shape

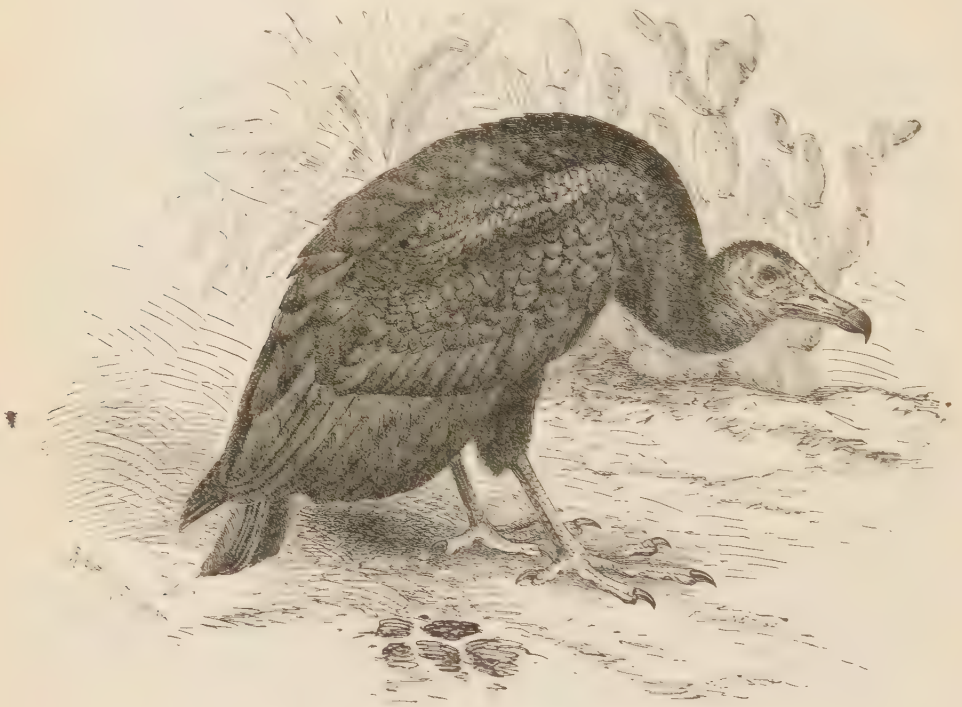


Fig. 388.—Black Vulture, ¼ nat. size. (From Brehm.)

between *Cathartes* and *Catharista* is strikingly displayed when the birds are seen flying together, there is also a decided difference in the mode of flight, as *Catharista* never sails for any distance without interrupting that easy motion by flapping the wings.

538. C. atra'ta. (Lat. *atrata*, blackened. Fig. 388.) Carrion Crow. Black Vulture. Adult ♂ ♀: Entire plumage, including skin of head, and bill, blackish; shafts of the primaries white; bases of the primaries paling to gray or whitish. Tip of bill and feet grayish-yellow; iris brown; claws black. Smaller than *C. aura*, in linear dimensions, but a heavier bird; length about 2 feet; extent only about 4½ feet; wing 17.00 inches; tail 8.00; tarsus 3.00; middle toe rather less; chord of culmen without cere 1.00 or less. Nesting like that of *C. aura;* eggs similar, but larger, or at any rate longer; about 3.25×2.00. Chiefly S. Atlantic and Gulf States, especially maritime, there very numerous, out-numbering the turkey buzzards, and semidomesticated in the towns, where their good offices are appreciated; N. regularly to N. C.,

thence straggling to Mass. and even Maine; not authenticated as occurring on the Pacific side, but of general distribution in C. and S. Am.

No one can fail to observe with interest the great difference in the form and general appearance of the Turkey Buzzard and Carrion Crow when he compares them sitting side by side sunning themselves upon chimney or house-top; and especially the discrepancy in their mode of flight as they wheel together overhead in endless inosculating circles. The Turkey Buzzards look larger as they fly, though really they are lighter weights; they are dingy-brown, with a gray space underneath the wing; the tail is long; the fore-border of the wing is bent at a salient angle, and there is a corresponding reëntrance in its hind outline; the tips of the longest quills spread apart and bend upward; and one may watch these splendid flyers for hours without perceiving a movement of the pinions. Comparing now the Carrion Crows, they are seen to be more thick-set, with less sweep of wing and shorter and more rounded tail, beyond which the feet may project; the front edge of the wing is almost straight, and the back border sweeps around in a regular curve to meet it at an obtuse point, where the ends of the quills are neither spread apart nor bent upward. The birds show almost black instead of brown; in place of a large gray area under the wing, there is a smaller paler gray spot at the point of the wing. And, finally, the Carrion Crows flap their wings five or six times in rapid succession, then sail a few moments; their flight appears heavy, and even laborious, beside the stately motion of their relatives.

Obs.—*Cathartes burrovianus* Cass., B. N. A., 1858, p. 6; Eliot, B. N. A. pl. 36, a doubtful species, is said to inhabit Lower California.—From various accounts, it seems probable that the king vulture (*Gyparchus papa*) really occurs on our southern border, but this remains to be determined. (See Bartram, Trav. in Fla., p. 150; Cass., B. N. A., p. 6; Coues, Proc. Phila. Acad., 1866, p. 49; Allen, Bull. Mus. Comp. Zool., ii, 1871, p. 313; Coues, Bull. Nutt. Club, vi, 1881, p. 248.)

V. Order COLUMBÆ: Columbine Birds.

An essential character of birds typical of this group is found in the structure of the bill, which is horny and convex at the tip, somewhat contracted in the continuity, furnished at the base with a tumid membrane in which the nostrils open. There are four toes; three anterior, generally cleft to the base, but occasionally with slight webbing; one behind, with few exceptions perfectly insistent or not obviously elevated. The feet are never much lengthened; the tarsus is commonly shorter than the toes, either scutellate or extensively feathered, reticulate on the sides and behind, the envelope rather membranous than corneous. (One N. Am. genus, *Starnœnas*, has entirely reticulate tarsus and elevated hallux.) On the whole, the feet are insessorial, not rasorial; the habit is arboreal, not terrestrial; but there are many ground pigeons, some quite fowl-like; and progression is always gradient, never saltatory. The wings and tail do not afford ordinal characters; but it may be remarked that the rectrices are usually (not always) 12 or 14 instead of the higher numbers usual in gallinaceous birds; and that the wings are usually long and flat, not short and vaulted. The plumage is destitute of aftershafts (qu. *Didus*? small aftershafts in *Pterocletes*?). The syrinx has one pair of intrinsic muscles, if any (none in *Pterocletes*). The oil-gland is nude, when present (small in *Treron*, etc.; wanting in *Goura*, *Starnœnas*). The gall-bladder is generally absent (present exceptionally in some true Pigeons). The cœca are absent; or present, but small. There are two carotids. The gizzard is muscular. There are many good osteological characters. The palate is schizognathous. The nasal bones are schizorhinal. The sternum is doubly notched, or notched and fenestrate, on each side; the pectoral ridge of the humerus is salient and acute, and does not receive the insertion of the second pectoral muscle. The ambiens muscle is normally present, the birds being unquestionably homalogonatous; but is sometimes lost; the femoro-caudal, accessory femoro-caudal, semitendinosus, and accessory semitendinosus are present; the fourth glutæal muscle, which in other schizorhinal birds covers the femur-head, is undeveloped (*Garrod*).

Some ornithologists, like Liljeborg, enlarge the Columbine order, under name of *Pullastræ*, to receive the American Curassows, (*Cracidæ*—see beyond) and the Old World Big-feet or Mound-birds (*Megapodidæ*); mainly on account, it would appear, of the low position of the hallux in these families. But the balance of characters favors their reference to the gallinaceous series, where they are relegated by Huxley. While there is no question that the Columbine birds are very closely related to the Galline, in fact inosculating therewith, it

seems best to draw the line, if one must be drawn, so as to include the *Pterocletes* in *Columbæ*, and leave the *Cracidæ* and *Megapodidæ* with *Gallinæ*. The Sand-grouse (better Sand-pigeons), or *Pterocletes*, represent the inosculation of the two series. They are terrestrial Columbines, modified for a grouse-like life; the digestive system is fowl-like (cœca several inches long, etc.); but the pterylosis, the sternum and humerus, the cranial and many other characters, are pigeon-like. The only alternative to reference of *Pterocletes* to the Columbine series is their elevation to independent ordinal rank, as proposed by Huxley.

The *Columbæ*, as above indicated, are intended to be made conformable to Huxley's *Peristeromophæ* plus *Pterocletes*. Assuming the imperfectly-known extinct Dodo, *Didus ineptus*, to have been a modified Columbine, and considering the *Pterocletes* to represent a rasorial modification of the Columbine series, the Order *Columbæ* may be separated into THREE groups, or suborders, DIDI, PTEROCLETES, and PERISTERÆ, the first two certainly, the last probably, of a single family. The *Peristeræ* alone are American.

9. SUBORDER PERISTERÆ: TRUE COLUMBINE BIRDS.

(Equivalent to the *Peristeromorphæ* of Huxley; the *Gemitores* of Macgillivray, or *Columbæ* proper of most authors; the *Gyrantes* of Bonaparte, plus *Didunculus; Columbæ* of Garrod minus *Pterocletes*; *Pullastræ* of Liljeborg minus *Cracidæ* and *Megapodidæ*.) Skull schizognathous, schizorhinal; basipterygoids prominent; angle of mandible not produced; rostrum externally as above said. Sternum doubled-notched or notched and fenestrate, on each side; pectoral crest of humerus salient, acute. Carotids two. Syringeal muscles one pair. Cœca coli small or wanting; gizzard muscular; crop developed; gall-bladder generally absent. Fourth glutæal muscle undeveloped; second pectoral specially inserted; ambiens normally present, or wanting. Oil-gland nude, small, or wanting. Plumage without after-shafts. Feet insessorial; hallux normally insistent; tarsus normally scutellate. Rectrices normally 12 or 14. (Rasorial tendency in more rectrices, hallux up, and tarsus reticulate.) Altricial; psilopædic; monogamous; eggs few. One family?

34. Family COLUMBIDÆ: Pigeons.

FIG. 389. — European Ring Dove (*Columba palumbus*). (From Dixon.)

The family is here taken to be co-extensive with the suborder as defined. With one exception (*Starnœnas cyanocephala*), all our species will be immediately recognized by their likeness to the familiar inmates of the dove-cot. One seemingly trivial circumstance is so constant as to become a good clue to these birds: the frontal feathers do not form antiæ by extension on either side of the culmen, but sweep across the base of the bill with a strongly convex outline projected on the culmen, thence rapidly retreating to the commissural point. The plumuleless plumage is generally compact, with thickened, spongy rhachis, the insertion of which will seem loose to one who skins a bird of this family. The head is remarkably small; the neck moderate; the body full, especially in the pectoral region. The wings are strong, generally lengthened and pointed, conferring a rapid, powerful, whistling flight; the peculiar aërial evolutions that these birds are wont to perform have furnished a synonym for the family, *Gyrantes*. The tail varies in shape, from square to graduate, but is never forked; as a rule there are 12 rectrices, frequently increased to 14, rarely to

16, exceptionally to 20; all the North American have 12, excepting *Zenaidura*, with 14. The feet show considerable modification when the strictly arboricole are compared with the more terrestrial species; their general character has just been indicated. The gizzard is large and muscular, particularly in the species that feed on seeds and other hard fruits; the gullet dilates to form a capacious circumscribed crop, divided into lateral halves, or tending to that state. This organ at times secretes a peculiar milky fluid, which, mixed with macerated food, is poured by regurgitation directly into the mouth of the young; thus the fabled "pigeon's milk" has a strong spice of fact, and in this remarkable circumstance we see probably the nearest approach, among birds, to the characteristic function of mammalia. "The voice of the turtle is heard in the land" as a plaintive cooing, so characteristic as to have afforded another name for the family, *Gemitores*. Pigeons are altricial, psilopædic, and monogamous — doubly monogamous, as is said when both sexes incubate and care for the young; this is a strong trait, compared with the præcocial, ptilopædic, and often polygamous nature of rasorial birds. They are amorous birds, whose passion generally results in a tender and constant devotion, edifying to contemplate, but is often marked by high irascibility and pugnacity — traits at variance with the amiable meekness which doves are supposed to symbolize. Their blandness is supposed to be due to absence of the gall-bladder. The nest, as a rule, is a rude, frail, flat structure of twigs; the eggs are usually two in number, sometimes one, white; when two, supposed to contain the germs of opposite sexes. (For anatomy of a pigeon, see frontispiece.)

"The entire number of Pigeons known to exist is about 300; of these the Malay Archipelago already counts 118, while only 28 are found in India, 23 in Australia, less than 40 in Africa, and not more than 80 in the whole of America." They focus in the small district of which New Guinea is the centre, where more than a fourth of the species occur. Mr. Wallace accounts for this by the absence of fruit-eating forest mammals, such as monkeys and squirrels; and finds in the converse the reason why pigeons are so scarce in the Amazon valley, and there chiefly represented by species feeding much on the ground and breeding in the bushes lower than monkeys habitually descend. "In the Malay countries, also, there are no great families of fruit-eating *Passeres*, and their place seems to be taken by the true fruit-pigeons, which, unchecked by rivals or enemies, often form with the *Psittaci* the prominent and characteristic features of the Avifauna." (*Newton.*)

There are several prominent groups of Pigeons; but authors are far from agreed upon the subdivisions of the family. It is not probable that Garrod's three subfamilies of *Columbidæ*, based upon characters of the ambiens, cœca, gall-bladder, and oil-gland, will not stand without modification, and I cannot adopt his arrangement. Sclater divided the suborder *Columbæ* as above defined into two families, *Columbidæ* and *Carpophagidæ*, to which he afterward added *Gouridæ*, and probably *Didunculidæ*. Bonaparte made five families, *Didunculidæ*, *Treronidæ*, *Columbidæ*, *Calœnadidæ*, and *Gouridæ* three of them upon single genera), with twelve subfamilies. Some of the leading groups may be thus indicated: —

1. The extraordinary Tooth-billed Pigeon of the Samoan Islands, *Didunculus strigirostris*, alone represents a subfamily or family, with its stout, compressed, hooked and toothed beak, and many other peculiarities. The length of intestine is excessive, being seven feet instead of about two, as usual in *Columbidæ*. The ambiens is present; the oil-gland and gall-bladder are absent. There are 14 tail-feathers.

2. The singular genus *Goura*, with two New-Guinean species, is outwardly distinguished by its immense umbrella-like crest, and possesses anatomical peculiarities which entitle it to stand alone as type of a subfamily or family. The tarsi are reticulate; there are 16 rectrices; cœca, gall-bladder, oil-gland, and ambiens muscle are all wanting; the intestines are four or five feet long.

3. The single genus and species, *Calœnas nicobarica*, has a very tumid bill, and acuminate, lengthened, pendulous feathers of the neck; but there are only 12 rectrices, as in

ordinary Pigeons, and the anatomy is conformable to a usual type, except that the lining of the gizzard is ossified.

4. The large Old World genera *Treron* and *Ptilopus*, with which latter another large genus, *Carpophaga*, is closely related, are a group of fruit-eating, arboricole species, with a short, stout beak, short, soft, broad-soled and extensively feathered feet, normally 14 rectrices, and soft lustreless plumage, of which green is the characteristic color. Of such *Treroninæ* or *Treronidæ*, "54 species are confined to the Austro-Malayan, while 28 inhabit the Indo-Malayan, subregion: In India 14, and in Africa a species are found; 30 inhabit the Pacific Islands, and 8 occur in Australia or New Zealand, while New Guinea has 14 species" (*Wallace*).

5. There are a large number of Pigeons of both the Old and New World, possessing neither the peculiarities already stated nor those of the *Columbinæ* proper, to be presently given. They are the *Zenaidinæ* and *Phapinæ* of Bonaparte, with more or less lengthened naked tarsi, and of more or less terrestrial habits. They are exemplified by such genera as *Chamæpelia* and *Melopelia* with 12 rectrices, and *Zenaidura* with 14, of America; by *Lophołæmus* with 12, *Geopelia*, *Phlogœnas* and *Ocyphaps* with 14, and *Phaps* with 16, of the Old World. Nearly all possess the ambiens and oil-gland, without cœca or gall-bladder. Having many points in common, these ground-doves might form a subfamily *Zenaidinæ* or *Phapinæ*, notwithstanding the peculiarities of certain genera. Such a group would correspond to the two Bonapartian subfamilies just named, and closely with the *Phapinæ* of Garrod.

6. From the *Zenaidinæ* thus composed our genus *Starnœnas* differs more notably than authors, excepting Garrod, seem to have appreciated. It is a pullet-like ground-pigeon, with long reticulate tarsus, short and somewhat elevated hind toe; with cœca and without oil-gland or ambiens muscle, the reverse of the rule in *Zenaidinæ* as above noted. It can hardly be referred to the totally different *Treroninæ* on the single circumstance of lacking the ambiens, and must stand alone, in such division of the family as is here sketched, as type of a new subfamily *Starnœnadinæ*.

7. With the remaining *Columbidæ* there is no difficulty, as they form a well characterized restricted subfamily *Columbinæ*. The leading genera are the square-tailed *Columba*, of both Worlds; the round-tailed *Turtur* of the Old; the wedge-tailed *Macropygia* of the Old, matched by the wedge-tailed *Ectopistes* of the New. The species are arboreal, with short feet, scutellate or partly-feathered tarsi, and 12 tail-feathers; cœca, oil-gland, and ambiens present; gall-bladder absent.

Of the seven groups thus indicated, three are North American. They may readily be distinguished as follows.

Analysis of North American Subfamilies of Columbidæ.

Tarsi scutellate, feathered	*Columbinæ*
Tarsi scutellate, naked	*Zenaidinæ*
Tarsi reticulate, naked	*Starnœnadinæ*

48. Subfamily COLUMBINÆ: Typical Pigeons.

Feet small; tarsus short, not longer than the lateral toes, scutellate in front, feathered above. Wing pointed, of 10 primaries. Tail variable in shape, of 12 rectrices. Bill typically as described above. Arboreal. (See above for anatomical characters.)

Analysis of Genera.

Tail nearly even, much shorter than the wing, with broad obtuse feathers	*Columba*	192
Tail long, cuneate, equal to wings, with narrow tapering feathers	*Ectopistes*	193

192. **COLUMBA.** (Lat. *columba*, a pigeon.) Bill short and comparatively stout, about half as long as head. Wings pointed, 2d and 3d quills longest. No black spots on scapulars. Lateral toes of about equal lengths, with claws about as long as middle toe without; hind toe and claw

about as long as lateral without. Contains the domestic Pigeon, *C. livia*, the Stock Dove, *C. œnas*, Ring Dove, *C. palumbus* (fig. 389), and several other species of both Hemispheres.

Analysis of Species.

A white band on nape; metallic scales of nape without borders. Tail with light terminal and dark subterminal bars; bill and feet yellow, former black-tipped. . . . . *fasciata* 539
No white on head; no metallic scales on nape; tail not banded; bill and feet not yellow . . *erythrina* 540
Top of head white; tail not banded; metallic feathers of nape black-bordered . . . . . *leucocephala* 541

539. C. fascia'ta. (Lat. *fasciata*, banded; alluding to the bars on the tail.) BAND-TAILED PIGEON. WHITE-COLLARED PIGEON. Adult ♂: Head, neck, and under parts purplish wine-red, fading to white on belly and crissum, the nape with a distinct white half-collar, the cervix with a patch of metallic, scaly bronze-green feathers. Rump, upper tail-coverts, lining of wings and sides of body slaty-blue. Back and scapulars dark greenish-brown, with considerable lustre, changing on the wing-coverts to slaty-blue, these feathers with light edging. Quills blackish-brown, with pale edging along the sinuous portion of the outer webs. Tail bluish-ash, paler beyond the middle on top and much paler below, crossed at the middle by a black bar. Bill yellow, tipped with black; feet yellow, claws black; a red ring round eye — these colors very conspicuous in life. A large stout species: length 16.00; extent about 27.00; wing 8.00–8.50, pointed; tail 5.50–6.00, square; bill 0.75, stout for a pigeon; tarsus 1.00, feathered half-way down in front; middle toe and claw 1.67. Adult ♀: Back, wings, and tail, as in ♂; metallic scales and white collar obscure or wanting. Head and under parts much less purplish, the rich hue replaced by a rusty-brown wash on an ashy ground; yellow of feet and bill obscured; smaller; wing 7.50; tail 4.75. Young ♂: Resembling the ♀. Rocky Mts. to the Pacific, U. S., common and of general but irregular distribution, chiefly in woodland, and especially where acorns, upon which it largely subsists, can be procured; sometimes in flocks of great extent. Nest in trees and bushes; eggs 2, equal-ended, white, glistening, 1.50×1.20.

540. C. erythri'na. (Gr. *ἐρυθρῖνος*, *eruthrinos*, reddish.) RED-BILLED PIGEON. Adult ♂: Head, neck, and breast dark purplish wine-red, with a slight glaucous overcast, like the bloom on a grape; no metallic scales on neck. Middle wing-coverts like the head. Middle of back, and some inner wing-quills, dark olive-brown with a bronze-green gloss. Greater wing-coverts, lining of wings, sides of body, belly, crissum, and rump, slate-colored, sometimes quite sooty, sometimes more bluish; tail like rump, but more blackish. Quills of wing dark slate with narrow pale edging. Bill pink for basal half, rest pale horn-color; feet purplish-red, with pale claws; eye-ring red; iris orange. Bill and feet drying an undefinable color. Bill remarkable for forward extension of feathers on culmen, to with half an inch of tip, covering the nasal scale. Length 13.50–14.50; extent 23.00–25.00; wing 7.50–8.00; tail about 5.00; tarsus 0.87; middle toe and claw 1.50. ♀ and young similar, duller and more dilute in color, the wine-red and slate-color more ashy. Texas, Mexico, Lower California. A dark, richly-colored pigeon, common in the Valley of Lower Rio Grande and southward. Nest in trees and bushes, of twigs, grasses, and roots, well-formed for a pigeon's; egg single, equal-ended, glistening white; averaging 1.54×1.09; laid in Apr., May.

541. C. leucoce'phala. (Gr. *λευκός*, *leucos*, white; *κεφαλή*, *kephale*, head.) WHITE-CROWNED PIGEON. Adult ♂ ♀: Dark slaty, paler below, the quills and tail feathers darkest. Whole top of head pure white; hind neck above rich maroon-brown, lower down and laterally metallic golden-green, each feather black-edged, giving the appearance of scales. Bill and feet dark carmine or lake red, the tip of the former bluish-white; bill drying dusky with yellowish tip, feet dingy yellowish. Iris yellow or white. Length 13.00–14.00; extent 23.00; wing 7.50; tail 5.75. ♀ only duller than ♂. West Indies and Florida Keys. Nest in trees and bushes, of twigs, roots, and grasses; eggs 2, white, 1.40 × 1.05.

193. ECTOPIS'TES. (Gr. *ἐκτοπιστής*, *ektopistes*, a wanderer: very appropriate.) PASSENGER

Pigeons. Tail long, equal to the wings, cuneate, of 12 tapering acuminate feathers, particolored. Wing acutely pointed by first 3 primaries, with black spots on the coverts. Bill small, with culmen less than half the head, short gonys, feathered far forward between the rami. Tarsi short, feathered part way down in front, where scutellate, but not in one regular row of scales. Lateral toes unequal. Sexes unlike.

543. E. migrato'rius. (Lat. *migratorius*, migratory. Fig. 390.) Passenger Pigeon. Wild Pigeon. Adult ♂: Upper parts, including head all around, slaty-blue, bright and pure on head and rump, shaded with olivaceous-gray on the back and wings; the back and sides of the neck glittering with golden and violet iridescence, the wing-coverts with velvety-black spots. Below, from the throat, light purplish-chestnut, paler behind and fading into white on the lower belly and crissum. Tibiæ, sides of body, and lining of wings like upper parts. Quills blackish, with rufous-white edging. Two middle tail-feathers blackish; others fading from pearly-bluish into white, their extreme bases with black and chestnut spots. Bill black; feet lake red, drying an undefinable color; iris orange; skin about eye red. Length about 17.00, but very variable, according to development of the tail; extent 23.00–25.00; wing 8.00–8.50; tail about the same, the lateral feathers graduated rather more than half its length; bill 0.75; tarsus 1.00; middle toe and claw 1.25. Adult ♀: Upper parts, wings and tail, as in ♂: below, brownish-gray, fading posteriorly. Young: Like the ♀, but still duller; little or no clear slaty except on rump; plumage varied with white crescentic edges of the feathers, especially on the back and wings; quills edged about with rufous; most of the lateral tail-feathers gray. "Wanders continually in search of food throughout all parts of N. Am.; wonderfully abundant at times in particular districts;" chiefly, however, temperate N. Am., East of the R. Mts. We do not have the "millions" that the earlier writers speak of in the Eastern U. S. now: but I remember one great flight over Washington when I was a boy: the greatest roosts and flights we now hear of are in the upper Mississippi Valley. Nest in trees and bushes, a slight frail platform of twigs, so open as to leave the egg visible from below. Eggs 1 or 2, equal-ended, 1.45 × 1.05.

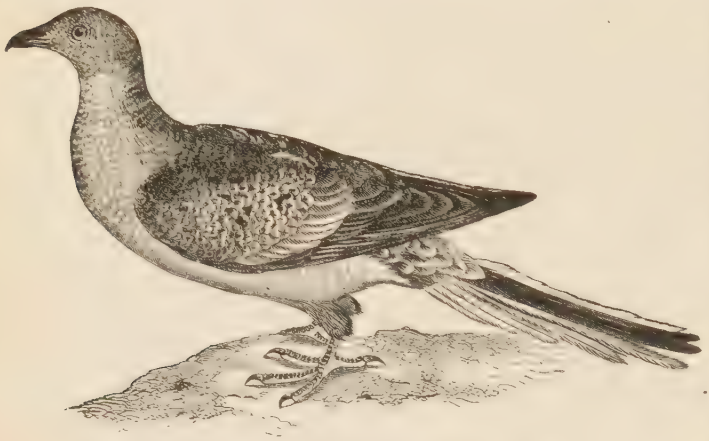


Fig. 390. — Passenger Pigeon. (From Tenney, after Wilson.)

49. Subfamily ZENAIDINÆ: Ground Doves.

Feet larger than in *Columbinæ*. Tarsus lengthened to exceed the lateral toes, entirely naked and scutellate in front (scarcely feathered in *Scardafella*). Tail-feathers normally 12, rarely 14 or more (*Zenaidura* the only North American Pigeon with more than 12). Seven North American genera, each of a single species in this country.

Analysis of Genera.

Tail of 14 feathers . . . . . *Zenaidura* 195
Tail of 12 feathers.
Outer primary attenuate, bistoury-like . . . . . *Engyptila* 194

Outer primary normal.
Tail longer than wing, double-rounded . . . . . *Scardafella* 199
Tail about equal to wing. Tarsus not shorter than middle toe and claw . . . . . *Geotrygon* 200
Tail shorter than wing. Tarsus shorter than middle toe and claw.
No blue-black spot nor metallic lustre on head or neck . . . . . *Chamæpelia* 198
A blue-black spot and metallic lustre on head or neck
Black spots and no white patch on wing . . . . . *Zenaida* 196
White patch and no black spots on wing . . . . . *Melopelia* 197

194. **ENGY'PTILA.** (Gr. *ἐγγύς*, *eggus*, narrow, straitened; *πτίλον*, *ptilon*, feather; alluding to the outer primary.) PIN-WING DOVES. First primary abruptly emarginate, attenuate and linear near the end. Wings of moderate length; 3d and 4th primaries longest; first shorter than 7th. Tail much shorter than the wings, rounded, of 12 broad feathers. Tarsus entirely naked, equalling or rather exceeding the middle toe and claw. Lateral toes nearly equal, the ends of their claws reaching about opposite the base of the middle claw. Hind toe shortest of all, but perfectly incumbent. Bill small and slender, much shorter than the head. A considerable

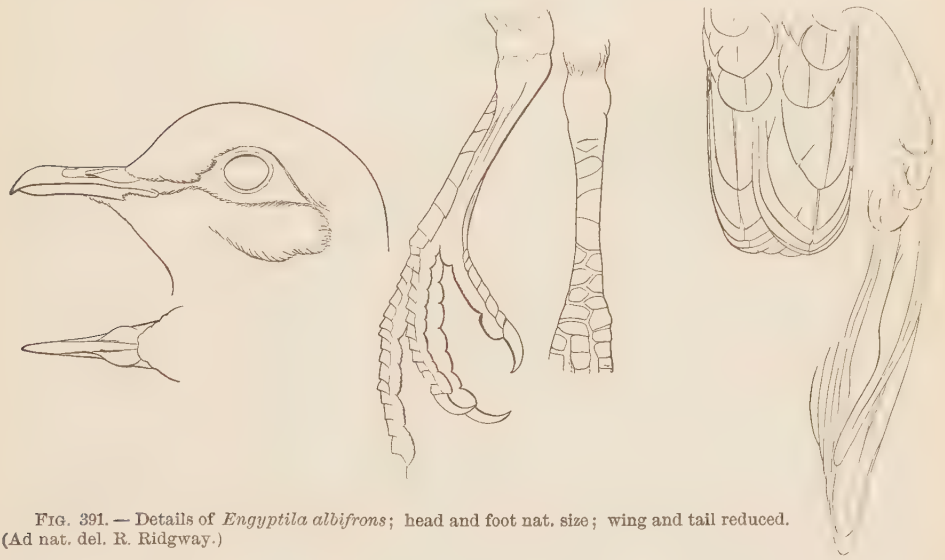


FIG. 391. — Details of *Engyptila albifrons*; head and foot nat. size; wing and tail reduced. (Ad nat. del. R. Ridgway.)

naked space about the eye, thence extending in a narrow line to the bill. Size medium or rather small. Body full and stout. Coloration subdued, but hind-head and neck iridescent. No metallic spots on wings or head. Lining of wings chestnut. (Only N. Am. genus with attenuate outer primary.)

542. **E. al'bifrons.** (Lat. *albus*, white; *frons*, forehead. Fig. 391.) WHITE-FRONTED DOVE. ♂, adult: Upper parts brownish-olive, with silky lustre (much as in *Coccygus americanus* for example). Hind-head, nape, and back and sides of neck with coppery-purplish iridescence. Top of the head of a bluish or glaucous "bloom," fading to creamy-white on the forehead. Under parts dull white or whitish, more or less shaded with olive-brown on the sides, deepening on the fore-breast and jugulum to pale vinaceous; belly, crissum, and chin quite purely white. Wing-coverts and inner quills like the back, and without metallic spots; other larger remiges slaty-blackish, with very narrow pale edging toward the end. Under wing-coverts and axillaries bright chestnut. Two middle tail-feathers like the back; others slaty-black, tipped with white in decreasing amount from the outer ones inward, the largest white tips about half an inch in extent. Bill black. Feet carmine-red. Iris yellow. Bare skin around eye red and

livid blue. Length 12.00–12.50; extent 19.00–19.50; wing 6.00–6.30; tail 4.25–4.50; bill 0.60–0.70; tarsus 1.25–1.35; middle toe and claw rather less. ♀ similar. (In printing the Check List, the No. of this species accidentally transposed with No. 543, *Ectopistes*.)

195. **ZENAIDU'RA**. (*Zenaida*, nom. propr., and *οὐρά*, *oura*, tail.) PIN-TAIL DOVES. Tail long, about equalling wings, cuneate, of 14 narrow, tapering, obtuse-ended feathers (unique among N. Am. *Columbidæ*). Wings pointed; 2d primary rather longest, 1st and the 3d about equal and scarcely shorter. Tarsus naked, scutellate in front, in length intermediate between middle and lateral toes; the latter of unequal lengths, the outer shortest. Bill much shorter than head, slender and weak, the feathers running out far between the rami. A bare circum-orbital space. Velvety black spots on head and wings. Lining of wings not rufous. Sexes unlike. There is a curious mimicry of *Ectopistes* in form and even in color; but the technical characters are widely different.

544. **Z. carolinen'sis**. (Of Carolina. Fig. 392.) CAROLINA DOVE. MOURNING DOVE. WILD DOVE. Adult ♂: Upper parts, including middle tail-feathers, grayish-blue shaded with brownish-olive, the head and neck ochrey-brown overlaid with glaucous-blue, the sides of the neck glittering with golden and ruby iridescence; a violet-black spot under the ear-coverts. Under parts glaucous-purplish, changing gradually to ochraceous on the belly and crissum, to bluish on the sides and under the wings, to whitish on the chin; the purplish tint spreading up on the sides and front of the head to blend with the glaucous-blue. Black spots on some of the scapulars and wing-coverts, most of which are colored to correspond with the back, the larger ones being rather bluish-plumbeous. Lateral tail-feathers plumbeous-bluish, crossed with a black bar, the outer four on each side broadly ended with white. Bill black; angle of mouth carmine; iris brown; bare skin around eye livid bluish; feet lake-red, drying dull yellowish. Length about 12.50: extent about 18.00; wing 5.75; tail the same, the feathers graduated for half its length; culmen 0.60; tarsus 0.80; middle toe and claw 1.00. ♀, adult: A little smaller, not purplish below, the rich color replaced by grayish-brown, like the back but paler; head and neck with little of the glaucous blue shade, and less iridescent. Young: Like the ♀; but at an early age the velvety-black spots and iridescence are wanting, and the general tone is quite gray; many feathers with whitish edging, as in the wild pigeon, with which not only the colors but the sexual and juvenile differences are thus closely correspondent. Temperate N. A., anywhere, the most widely and equably diffused of its tribe, abundant in most localities, in some swarming; "millions" in Arizona, for example. Irregularly migratory, imperfectly gregarious; great numbers may be together, but scarcely in compact flocks. Terrestrial rather than arboreal, almost always feeding on the ground; where very numerous, they become familiar, like blackbirds in the West. Nest indifferently on the ground or in bushes; eggs 2, white, equal-ended, averaging 1.12 × 0.82; 2 or even 3 broods in the South. During the mating season, where these birds are numerous, their cooing resounds on every hand, but at other times they are silent.

FIG. 392. — Carolina Dove, nat. size. (Ad nat. del. E. C.)

196. **ZENAI'DA**. (A proper name, that of Zénaïde, cousin and wife of Prince C. L. Bonaparte.) LOVE DOVES. Tail rounded, shorter than wings, of 12 feathers. Wings long, pointed by 2d and 3d quills; 1st little shorter. Bill short, slender, black. Feet as in other *Zenaidinæ;* tarsus intermediate in length between the middle and lateral toes; these of unequal length, inner a little the longer. Circumorbital space little bare. Metallic iridescence on neck; blue-black ear-spot, and others on wings. Sexes similar. (West Indian.)

545. Z. ama'bilis. (Lat. *amabilis*, lovely.) ZENAIDA DOVE. Olive-gray with a reddish tinge; crown and under parts vinaceous-red; sides and axillars bluish; a velvety-black auricular spot, and others on the wing-coverts and tertiaries; secondaries tipped with white; neck with metallic lustre; middle tail-feathers like the back, others bluish with whiter tips, a black band intervening; bill black with crimson corners of the mouth; iris brown; feet red; claws black. Length about 10.00; wing 6.00; tail 4.00. West Indies and Florida Keys.

197. **MELOPELI'A.** (Gr. *μέλος*, *melos*, melody; *πέλεια*, *peleia*, a dove.) WHITE-WING DOVES. Tail rounded, shorter than wing, of 12 broad, rounded feathers. Wings pointed; 1st, 2d, and 3d primaries nearly equal and longest. Bill slender and lengthened, equalling tarsus, black. A large bare circumorbital space. A blue-black spot below auriculars, but none on wings; neck with metallic lustre. A great white space on wing. Feet as in other *Zenaidinæ*. Sexes alike.

546. M. leuco'ptera. (Gr. *λευκός*, *leucos*, white; *πτερόν*, *pteron*, wing.) WHITE-WING DOVE. Wing with a broad white bar oblique from the carpal joint to the ends of the longest coverts, continued by white edging at and near ends of outer webs of the secondaries: very conspicuous, recognizable at gun-shot range. Lower back and rump, some of the middle coverts, lining of wings, and entire under parts from the breast, fine light bluish-ash. Primaries blackish with narrow white edging. Tail, excepting two middle feathers, slaty-blue, becoming gradually slaty-black, then broadly and squarely tipped with ashy-white. General color of back, lesser wing-coverts, inner quills, and middle tail-feathers, olive-brown with some lustre; the tail-feathers browner; the top of head and back of neck purplish-vinous with a slight glaucous shade; sides of neck iridescent with golden-green; a violet or steel-blue spot below auriculars. Bill black, very slender. Length 11.25–12.25; extent 19.00–20.00; wing 6.00–6.50; tail 4.00–4.50; bill 0.87; tarsus 0.87; middle toe and claw 1.25. ♀ scarcely distinguishable. In the youngest, the white wing-bar appears, though there is little or no purplish, or iridescence, or blue-black below ears. Texas, New Mexico, Arizona and S. Cala. and southward, abundant in suitable localities. In the breeding season, Apr.–May, the sonorous cooing is incessant. Nest in bushes and low trees, slight and frail, of sticks and weeds; eggs 2, white *or creamy*, averaging 1.18×0.88.

198. **CHAMÆPELI'A.** (Gr. *χαμαί*, *chamai*, on the ground; *πέλεια*, *peleia*, a dove.) DWARF DOVES. Very small. Wings short and broad, with elongated inner secondaries, nearly overreaching primaries in the folded wing. Tail still shorter than wing, nearly even, of 12 broad feathers. Bill slender, about half as long as head, mostly yellow. Feet largely zenaidine; tarsus as long as middle toe without claw. No iridescence nor blue-black spot on head; such spots on wings. Sexes unlike, but *Arcades ambo*.

547. C. passeri'na. (Lat. *passerina*, sparrow-like; from the pygmy stature.) GROUND DOVE. Grayish-olive, glossed with blue on the hind head and neck, most feathers of the fore-parts with darker edges, those of the breast with dusky centres. Forehead, sides of head and neck, lesser wing-coverts and under parts purplish-red of variable intensity, paler or grayish on the belly and crissum; under surface of wings orange-brown or chestnut, this color suffusing the quills to a great extent; upper surface of wings sprinkled with lustrous steel-blue spots. Middle tail-feathers like the back, others plumbeous, blackening toward ends, with paler tips. Feet yellow; bill yellow with dark tip. Diminutive: length 6.50–7.00; extent 10.00–11.00; wing 3.50, with inner secondaries nearly as long as the primaries; tail 2.75, rounded; bill 0.45; tarsus 0.67; middle toe and claw 0.75. ♀ and young differ as those of the wild pigeon and carolina dove do, the purplish tints being replaced by gray or "ashes of roses," the very young bird having whitish skirting of the feathers. Southern U. S., Atlantic to Pacific, but chiefly coastwise; N. to the Carolinas, and accidentally to Washington, D. C.; common. Nest on the ground or in bushes indifferently; eggs 2, white, 0.87×0.63.

548. C. p. palles'cens? (Lat. *pallescens*, bleaching.) Scarcely different; described as paler. Cape St. Lucas.

199. **SCARDAFEL'LA.** (Italian, signalizing the scaly appearance of the feathers, due to their color.) SHELL DOVES. Tail of peculiar shape, double-rounded, median and lateral feathers both shorter than intermediate ones; all narrow and tapering; 12 in number. Wings as in *Chamæpelia*. Bill very slender, rather long, black. Feet not typically zenaidine; tarsus very short, slightly feathered above. No blue-black spots on head or wings; no iridescence on neck. Size very small. Sexes similar. Remarkable genus, of 2 tropical Am. species, one reaching our border.

549. **S. in'ca.** (*Inca* or *yncas*, a Peruvian title.) INCA DOVE. SCALED DOVE. ♂ ♀, adult: Above, grayish-brown with the usual olive shade, anteriorly also with a slight "ashes of roses" hue; below, pale ashy-lilac, changing to ochraceous on the belly and crissum — nearly all the plumage marked with black crescentic edges of the feathers, producing the shelly or scaly appearance. Primaries and bastard quills intense chestnut, with blackish ends; lining of

FIG. 393. — Blue-headed Quail Dove, ½ nat. size. (From Brehm.)

wings black and chestnut; outer secondaries blackish with chestnut central areas, gradually diminishing till the inner secondaries assimilate with the color of the back. Middle tail-feathers like back; three lateral ones basally plumbeous, then black, then broadly tipped with white — the black running out into the white as a shaft line. ♀ similar to ♂; young similar, but with little or no ashy-rosy, and sprinkled with white on upper parts. Length about 8.00; wing 3.75; tail more; bill 0.45; tarsus 0.50; middle toe and claw 0.87. A very pretty little dove, with mahogany wings upholstered in shell-figured ashes-of-roses velvet; a curious miniature of the common dove in form. Mexico to Texas, New Mexico and Arizona, along the borders. Nest in bushes; eggs 2, white, 0.90×0.70.

200. **GEOTRY'GON.** (Gr. *γέα*, *gea*, the earth; *τρυγών*, *trugon*, a cooer.) LUSTRE DOVES. Tail about as long as wings, a little rounded, of 12 broad rounded feathers, with curved shafts.

Wings short, rounded; 3d and 4th quills longest, 2d and 4th little shorter, 1st much shorter. Feet strongly zenaidine; tarsus not shorter than middle toe and claw; still, scutellate in front, and hind toe more than half as long as the middle, perfectly insistent. Bill rather long and stout; frontal feathers obtuse on culmen. Head and wings without blue-black spots; whole upper parts highly lustrous. Medium size; form stocky, somewhat quail-like, but tail long. Approaching the next, but at a distance. West Indian and Tropical American.

550. **G. martiʹnica.** (Of Martinique.) KEY WEST DOVE. Above, vinaceous-red with highly iridescent lustre of various tints; below, pale purplish fading to creamy; an infra-ocular stripe and the throat white. Length 11.00; wing and tail about 6.00. West Indies and Key West. Florida, where not observed of late.

50. Subfamily STARNŒNADINÆ: Quail Doves.

See p. 564. Hallux not perfectly insistent; short, only about half as long as the middle toe and claw. Feet large and stout; tarsus longer than the middle toe, entirely bare of feathers even on the joint, completely covered with small hexagonal scales. With cœca, but without oil-gland or ambiens muscle, the reverse of the *Zenaidinæ*, of which it is a remarkable outlying form, grading toward gallinaceous birds in structure and habits; like some partridges even to the special head-markings. Including one isolated American genus and species, not referable to any established Old World group.

201. **STARNŒʹNAS.** (*Starna*, name of a genus of partridges; Gr. *οἰνάς*, *œnas*, a dove.) QUAIL DOVES. In addition to the foregoing: Bill short, stout; frontal feathers projected in a point on culmen. Wings short, broad, vaulted and much rounded; first primary reduced. Tail short, broad, nearly even. Size medium; whole form and appearance quail-like. West Indian.

551. **S. cyanoceʹphala.** (Gr. *κυανός*, *kuanos*, blue; *κεφαλή*, *kephale*, head. Fig. 393.) BLUE-HEADED QUAIL DOVE. Crown rich blue bounded by black; a white stripe under the eye, meeting its fellow on the chin; throat black, bordered with white. General color olivaceous-chocolate above, purplish-red below, lighter centrally. Length 11.00; wing 5.50; tail 4.50. West Indies and Florida Keys.

VI. Order GALLINÆ: Gallinaceous Birds; Fowls.

Equivalent to the old order *Rasores*, exclusive of the Pigeons — this name being derived from the characteristic habit of scratching the ground in search of food; connecting the lower terrestrial pigeons with the higher members of the great plover-snipe group. On the one hand, it shades into the *Columbæ* so perfectly that Huxley has proposed to call the two together the "Gallo-columbine series;" on the other hand, some of its genera show a strong plover-ward tendency, and have even been placed in *Limicolæ*. I have already (p. 562) noted the inosculation of *Gallinæ* with *Columbæ* by means of the grouse-like Pigeons, *Pterocletes;* it remains to indicate the limits of the *Gallinæ* in other directions, by referring to two remarkable groups, one represented by *Opisthocomus* alone, the other consisting of the Hemipods or *Turnices*. Both of these have usually been referred to *Gallinæ*.

1. The wonderful Hoatzin of Guiana, *Opisthocomus cristatus*, is one of the most isolated and puzzling forms in ornithology, sometimes placed near the *Musophagidæ*, but assigned by maturer judgment to the neighborhood of the fowls, which it resembles in many respects, as an independent order OPISTHOCOMI, sole relict of an ancestral type. The sternum and shoulder-girdle are anomalous; the keel is cut away in front; the furcula anchylose with the coracoids (very rare) and with the manubrium of the sternum (unique); the digestive system is scarcely less singular; and other characters are remarkable.

2. The bush-quails of the Old World, *Turnicidæ*, differ widely from the *Gallinæ*, resembling the Grouse-pigeons and Tinamous in some respects, and related to the Plovers in

others. A singular circumstance is a lack of the extensive vertebral anchyloses usual in birds, all the vertebræ remaining distinct. The palatal structure is curiously like that of *Passeres* (ægithognathous). The crop is said to be wanting in some; as is also the hind toe, and one of the carotids. There are some 20 current species of the principal genus, *Turnix*, to which Gray adds the African *Ortyxelos meiffreni*, and the Australian *Pedionomus torquatus*. Late studies of the group have resulted in the view that it should represent a distinct order, HEMIPODII.

Elimination of these non-conformable elements renders the *Gallinæ* susceptible of much better definition, as follows: —

Bill generally short, stout, convex, with obtuse vaulted tip, not constricted in the continuity, wholly hard and corneous except in the nasal fossa. Tomia of upper mandible overlapping the lower; culmen high on forehead, the frontal feathers there forming a re-entrance, with more or less salience on either side. Nostrils scaled or feathered, in a short abrupt fossa. Legs usually feathered to the suffrago, often to the toes, sometimes to the claws. Hallux elevated, excepting in *Cracidæ* and *Megapodidæ*, normally shorter than the anterior toes. Tarsus generally broadly scutellate, when not feathered. Front toes commonly webbed at base. Claws blunt, little curved. Wings short, strong, vaulted. Rectrices commonly more than 12 (not more in *Cracidæ*, beyond). Head and brain small in proportion to the body, as in Pigeons. Plumage with after-shafts. Oil-gland tufted. Carotids two (except in *Megapodidæ*). No intrinsic syringeal muscles. Sternum generally deeply doubly-notched, and furculum with a hypocleidium. Palate schizognathous. Nasal bones schizorhinal. Sessile basipterygoid processes present. Angle of mandible produced into a recurved process. Pectoral muscles, three; the second extensive; femoro-caudal variable; accessory femoro-caudal, semi-tendinosus, accessory semi-tendinosus and ambiens present. Intestinal cœca extensive; gizzard muscular. Nature præcocial and ptilopædic, typically polygamous. Chiefly terrestrial.

The order thus defined is equivalent to the *Alectoromorphæ* of Huxley (1867), minus *Pterocletes* and *Hemipodii*. The birds composing it fall into two series or suborders, according to the structure of the feet and more essential characters.

10. SUBORDER PERISTEROPODES: PIGEON-TOED FOWLS.

Framed to accommodate the Old World *Megapodidæ*, or Mound-birds, and the American *Cracidæ*, or Curassows.

The Mound-birds, *Megapodidæ*, as the name implies, have large feet, with little-curved claws, and lengthened insistent hallux. They share this last feature with the *Cracidæ* (beyond); and the osseous structure of these two families, except as regards pneumaticity, is strikingly similar. Both show a modification of the sternum, the inner one of the two notches being less instead of more than half as deep as the sternum is long, as in typical *Gallinæ*. The Megapods do not incubate, and the young pass through the downy stage in the egg, hatching with true feathers (p. 226). They are confined to Australia and the East Indies; *Megapodius* is the principal genus, of a dozen or more species; there are three others, each of a species or two.

35. Family CRACIDÆ: Curassows.

This type is peculiar to America, where it may be considered to represent the *Megapodidæ*, though differing so much in habit and general appearance. The affinities of the two are indicated above, and some essential characters noted. According to the latest authority on the family, Messrs. Sclater and Salvin, it is divisible into three subfamilies: *Cracinæ*, curassows and hoccos, with four genera and twelve species; *Oreophasinæ*, with a single genus and species, *Oreophasis derbianus*, and the

51. Subfamily PENELOPINÆ: Guans,

with seven genera and thirty-nine species, one of which reaches our border.

202. **ORTALIS**. (Gr. ὀρταλίς, *ortalis*, a pullet.) Guans. Head crested; its sides, and strips on the chin, naked, but no wattles. Tarsi naked, scutellate before and behind, with small scales between the scutellar rows. Hind toe insistent, about ½ the middle toe. Tail graduated, ample, fan-shaped, longer than the much rounded wings, of 12 broad, obtuse feathers. Wings short, concavo-convex, with abbreviated outer primaries, the secondaries reaching about to the ends of the longest primaries when the wing is folded. Bill slender for a gallinaceous bird, without decided frontal antiæ. Coloration greenish. Sexes alike. In some points of size, shape, and general aspect, there is a curious superficial resemblance between this genus and *Geococcyx*, though the two genera belong to different orders of birds.

552. **O. ve'tula maccal'li**. (Lat. *vetula*, a little old woman. To Geo. A. McCall.) Texan Guan. Chachalaca. Dark glossy olivaceous, paler and tinged with brownish-yellow below, plumbeous on the head; tail lustrous green, tipped with grayish-white except on the middle pair of feathers; bill and feet plumbeous; iris brown. Length 22.00–24.00; extent 24.00–28.00; wing 7.50–9.00; tail 9.00–11.00; tarsus 2.00 or more; middle toe and claw about the same. ♀ similar. Downy young: Above, mixed brown, ashy and tawny, with a black central stripe from bill to tail; below white, ashy on the jugulum. Mexico to Texas in the Lower Rio Grande Valley, abounding in some localities. A notable bird, unlike anything else in this country. Easily domesticated, said to be used as a game fowl. Very noisy in the breeding season (April), reiterating the syllables *cha-cha-lac* in a loud hoarse tone. Nest in bushes, a slight structure; eggs generally 3, with a thick, granular, and very hard shell, like a Guinea-fowl's, oblong-oval, buff-colored or creamy-white, large for the bird, 2.35×1.60.

11. Suborder ALECTOROPODES: True Fowls.

The birds of this suborder are more or less perfectly terrestrial; the legs are of mean length, and stout; the toes four, three in front, generally connected by basal webbing, but sometimes free, and one behind, always short and elevated. The tibiæ are rarely naked below; the tarsi often feathered, as the toes also sometimes are; but ordinarily both these are naked, scutellate and reticulate, and often developing processes (*spurs*) of horny substance with a bony core, like the horns of cattle. The bill as a rule is short, stout, convex, and obtuse; never cered, nor extensively membranous; the base of the culmen parts prominent antiæ, which frequently fill the nasal fossæ; when naked the nostrils show a superincumbent scale. The head is frequently naked, wholly or partly, and often develops remarkable fleshy processes. The wings are short, stout, and concavo-convex, conferring power of rapid, whirring, but unprotracted, flight. The tail varies extremely; it is very small in some genera, enormously developed in others; the rectrices vary in number, but are commonly more than twelve. The sternum without certain exception shows a peculiar conformation; the posterior notches seen in most birds are inordinately enlarged, so that the bone, viewed vertically, seems in most of its extent to be simply a narrow central projection, with two long backward processes on each side, the outer commonly hammer-shaped. There are other distinctive osteological characters, as noted above. The digestive system presents an ample special crop, a highly muscular gizzard, and large cœca. The inferior larynx is always devoid of intrinsic muscles; the structure of the trachea varies with genera, presenting some curious modifications. There are after-shafts, and a circlet around the oil-gland. *Alectoropodes* are præcocial and ptilopædic. A part of them are polygamous — a circumstance shown in its perfection by the sultan of the dung-hill with his disciplined harem; and in all such, the sexes are conspicuously dissimilar. The rest are monogamous, and the sexes of these are as a rule nearly or quite alike. The

eggs are very numerous, usually laid on the ground, in a rude nest, or none. The suborder is cosmopolitan; but most of its groups have a special geographical distribution. Its great economic importance is perceived in all forms of domestic poultry, and principal game-birds of various countries; and it is unsurpassed in beauty — some of these birds offer the most gorgeous coloring of the class.

FIG. 394. — English Pheasant, *Phasianus colchicus*. (From Dixon.)

Genetically, the Fowls are nearer than most birds to a generalized, old-fashioned type. They have relations in the curiously ostrich-like Tinamous of South America (*Tinamidæ* or *Crypturi*), the Hoatzin (*Opisthocomus*), and other antique relicts. Notice a quarter-grown Turkey with this idea in mind, and you will hardly fail to see that it looks like an ostrich in miniature. Leading types of existing Alectoropod *Gallinæ* are the Quail, the Grouse, the Guinea-fowl, the Turkey, and the domestic Cock. The two former are very close to each other, and hardly separable as families; the three latter are nearer one another, and often placed together in a family. The families *Tetraonidæ*, Grouse, Quail, and Partridges; and *Meleagrididæ*, Turkeys, are indigenous to N. Am., and fully treated beyond. A word on the others will not be misplaced here.

The Guinea-fowl, *Numididæ*, of which a species, *Numida meleagris*, is commonly seen in domestication, are an African and Madagascan type. While the foregoing families are strongly specialized, this one, like the turkey family, more closely approaches the true fowl, and both may be only subfamilies of *Phasianidæ*. The bones of the pinion have a certain peculiarity; the frontal generally develops a protuberance; there are wattles, but no spurs; the tail is very short; the head naked. There are six or eight species of *Numida*, in some of

which the trachea is convoluted in an appendage to the furculum; *Acryllium vulturina*, *Agelastes meleagrides*, and *Phasidus niger*, are the remaining ones.

The *Phasianidæ*, or Pheasants, are a magnificent family of typical *Gallinæ*, of which the domestic fowl is a characteristic example. The feet, nasal fossæ, and usually a part, if not the whole, of the head, are naked, and often combed, horned, or wattled. The tarsi commonly develop spurs. The tail, with or without its coverts, sometimes has an extraordinary development or a remarkable shape (p. 118). There are fifty or sixty species, distributed in numerous modern genera, about twelve of which are well marked; they are all indigenous to Asia and neighboring islands, focusing in India. In the Peacock, *Pavo cristatus*, the tail-coverts form a superb train, capable of erection into a disk, the most gorgeous object in ornithology; in an allied genus, *Polyplectron*, there are a pair of spurs on each leg. The Argus Pheasant, *Argusanus giganteus*, is distinguished by the enormous development of the secondary quills, as well as by the length of the tail-feathers and peculiarity of the middle pair. The combed, wattled, and spurred barn-yard fowl, with folded tail and flowing middle feathers, are descendants of *Gallus bankiva*, type of a small genus. The Tragopans, *Ceriornis*, are an allied form with few species; the Macartneys, *Euplocomus*, with a dozen species, are another near form, as are the Impeyans, *Lophophorus*, with a slender aigrette on the head, like a peacock's. The naturalized English pheasant, *P. colchicus* (fig. 394), introduced into Britain prior to A. D. 1056, is the type of *Phasianus*, in which the tail-feathers are very long and narrow; in one species, *P. reevesii*, the tail is said to attain a length of six feet. The Golden and Amherstian Pheasants, *Chrysolophus pictus* and *C. amherstiæ*, are singularly beautiful, even for this group. The other genera are *Crossoptilon* and *Pucrasia*.

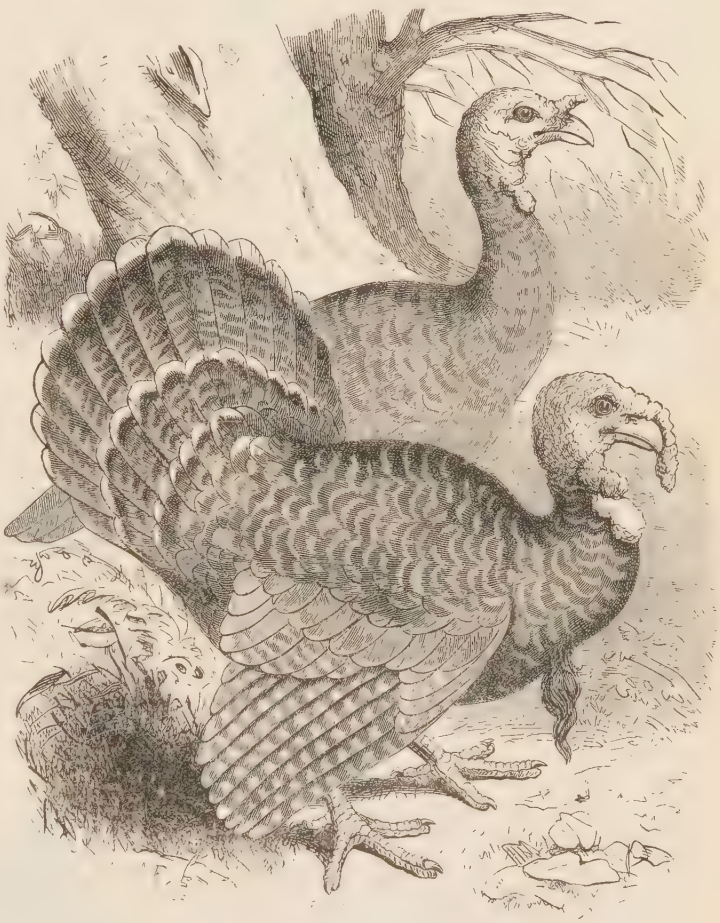


FIG. 395. — Turkey. (From Lewis.)

36. Family MELEAGRIDIDÆ: Turkeys.

Head and upper neck naked, carunculate; in our species with a dewlap and erectile process. Tarsi naked, scutellate before and behind, spurred in the ♂. Tail broad, rounded, of 14–18 feathers. Plumage compact, lustrous; in our species with a tuft of hair-like feathers on the breast. One genus, two species. *M. ocellatus* is the very beautiful Turkey of Central America.

203. **MELEA/GRIS.** (Gr. μελεαγρίς, Lat. *meleagris*, a guinea-fowl; transferred in ornithology to this genus.) TURKEYS. Characters of the family.

553. **M. gallipa/vo.** (Lat. *gallus*, a cock, *pavo*, a pea-fowl. Fig. 395.) TURKEY. Upper tail-coverts chestnut, with paler or whitish tips; tail-feathers tipped with brownish-yellow or whitish; 3–4 feet long, etc. Wild in Texas, New Mexico, Arizona and southward; domesticated elsewhere. The Mexican bird is the original of the domestic race; it was upon this form, imported into Europe, that Linnæus imposed the name *gallopavo* (Fn. Suec. No. 198; Syst. Nat. i, 1766, 268), which has generally been applied to the following feral variety:

554. **M. g. america/na.** EASTERN WILD TURKEY. Upper tail-coverts without light tips, and ends of tail-feathers scarcely paler. This is the ordinary wild turkey of Eastern North America; N. to Canada, where it is said still to occur; extirpated in New England. NW. to the Missouri, and SW. to Texas. The slight differences just noted seem to be remarkably constant, and to be rarely if ever shown by the other form; although, as usual in domestic birds, this last varies interminably in color.

37. Family TETRAONIDÆ: Grouse; Partridge; Quail.

All the remaining gallinaceous birds are very closely related, probably constituting a single family; although the term *Tetraonidæ* is usually restricted to the true Grouse as below defined (*Tetraoninæ*), the Partridges and Quails being erected into another family, *Perdicidæ*, with several subfamilies. But the Grouse do not appear to differ more from the Partridges and Quails than these do from each other, and they are all variously interrelated; so that no violence will be offered in uniting them. One group of the Partridges (*Odontophorinæ*) is confined to America; all the rest to the Old World. The leading forms among the latter are *Perdix*, the true partridge; *Coturnix*, the true Quail; *Francolinus*, the Francolins; with *Rollulus* and *Caccabis*. In all, perhaps a hundred species and a dozen genera. Without attempting to frame a family diagnosis to cover all their modifications, I will precisely define the American forms, as two subfamilies.

Analysis of Subfamilies.

TETRAONINÆ. *Grouse.* The shank (tarsus) more or less feathered. (Plenty more characters, but this is perfectly distinctive.)

ODONTOPHORINÆ. *American Partridges and Quails.* The shank entirely bare and scaly. (Plenty more characters, etc.)

OBS. — The vernacular names "pheasant," "partridge," and "quail," as applied to our game birds in different sections of the country, are the cause of endless confusion and misunderstanding, which it seems hopeless to attempt to do away with. (1.) The word "pheasant" (derived from the name of the river Phasis in Colchis) belongs to certain Old World *Phasianidæ* (see above; and fig. 394) having no representatives in America. But early settlers of this country applied it to the Ruffed Grouse, *Bonasa umbella* — and "pheasant" is the Ruffed Grouse called to this day by the common people of the Middle and Southern States. (2.) "Partridge" is an old English word, specifically designating the English *Perdix cinerea*, then enlarged in meaning to cover all the family *Perdicidæ* (see beyond). In the Northern States, both the Spruce Grouse, *Canace canadensis*, and the Ruffed Grouse, are commonly called "partridge." In the Middle

and Southern States — wherever the Ruffed Grouse is called "pheasant," the Bob-white, *Ortyx virginiana*, is called "partridge." (3.) The term "quail" is specially applicable to the European Migratory or Messina Quail, *Coturnix dactylisonans*. But this resembles our Bob-white not distantly, causing the latter to be called "quail" in the sections where the Ruffed and Spruce Grouse are called "partridge;" and in the Southwest, the species of *Lophortyx*, *Oreortyx*, and *Cyrtonyx* are universally called "quail." The following tabular statement should bring the matter clearly into view.

Summary of North American TETRAONIDÆ — *Grouse, Partridge, Quail.*

A. GROUSE, with feathers on shank (*Tetraoninæ*).

1. *Sage Fowl:* Sage Cock; Sage-Hen; Cock-of-the-Plains. Western. One species: *Centrocercus urophasianus.*
2. *Sharp-tailed Grouse:* Pin-tail Grouse; Prairie Hen or Prairie Chicken of the Northwest: 1 species, 2 varieties: *Pediœcetes phasianellus.*
3. *Pinnated Grouse:* common Prairie Hen or Prairie Chicken of the Mississippi, Ohio, and Lower Missouri valleys. One species; two varieties: *Cupidonia cupido.*
4. *Tree Grouse:* Spruce Grouse; Black Grouse; the Northern States species improperly called "partridge." One species, two varieties: *Canace canadensis.*
   Another species of 3 varieties, confined to the West: *Canace obscura.*
5. *Ruffed Grouse:* improperly called "partridge" in the Northern and "pheasant" in the Middle and Southern States. One species, *Bonasa umbella*, of 3 varieties.
6. *Snow Grouse*, or *Ptarmigan.* Three species of *Lagopus*, boreal and alpine, turning white in winter: *L. albus*, *L. rupestris*, *L. leucurus.*

B. PARTRIDGE and QUAIL, without feathers on shank (*Odontophorinæ*).

7. *The imported Messina Quail*, or Migratory Quail of Europe: one species: *Coturnix dactylisonans.*
8. *Bob-white:* called "quail" in Northern States; called "partridge" in the Middle and Southern States. One species: *Ortyx virginiana*, with 2 varieties, one in Florida, the other in Texas.
9. *Helmet Partridges:* of the Southwest, commonly called "quail," with a beautiful recurved top-knot. Two species of *Lophortyx: L. gambeli*, *L. californica*, commonly called "valley quail."
10. *Arrow Partridge:* with two long arrowy plumes on the head. One species, of California: *Orortyx picta*, commonly called "mountain quail."
11. *Shell Partridge:* bluish-white markings, as if scaly. One species, Southwest. *Callipepla squamata.*
12. *Massena Partridge* (not to be confused with the imported Messina Quail): with a soft crest and numberless white "eyes" on the belly. Southwest. One species: *Cyrtonyx massena.*

In all, 26 varieties, of 16 species, of 12 genera, of 2 subfamilies, of 1 family.

FIG. 396. — 'Red Game' of Britain, *Lagopus scoticus*. (From Dixon.)

52. Subfamily TETRAONINÆ: Grouse.

Head completely feathered, excepting, usually, a naked strip of skin over the eye. Nasal fossæ densely feathered. Tarsi more or less perfectly feathered, the feathering sometimes extending on the toes to the claws; the toes, when naked, with horny fringe-like processes. Tail variable in shape, but never folded.

of 16–20 feathers. Sides of the neck frequently with lengthened or otherwise modified feathers, or a bare distensible skin, or both.

The true Grouse are confined to the northern hemisphere, and reach their highest development, as a group, in North America, where singularly varied forms occur. The only Old World species are — the great *Tetrao urogallus*, or Capercaillie of Europe, and its allied Asiatic species: *Lyrurus tetrix*, the "black game" of Europe, with curiously curled tail-feathers; *Canace falcipennis* of Siberia, the representative of our Spruce Partridge: *Bonasa betulina* of Northern Europe and Asia, like our Ruffed Grouse; and two or three species of Ptarmigan (*Lagopus*).

All the species of this subfamily used to be referred to a single genus *Tetrao* — the only generic name familiar to sportsmen and others who make no technical study of birds. But such must not be surprised to find me discarding this well-known name, and adopting several different ones as generic designations of our Grouse, which differ much among themselves, in points of form and structure, and are all widely diverse from *Tetrao urogallus* of Europe, type of the genus.

Analysis of N. Am. Genera of Tetraoninæ.

Tail stiff, pointed, wedge-shaped, equalling or exceeding the wings, of 20 feathers; scaly and hair-like feathers on breast. Tarsi full-feathered. Very large . . . . . *Centrocercus* 205

Tail stiff, pointed, wedge-shaped, much shorter than wings, of 18 feathers; no obviously peculiar feathers on neck. Tarsi full-feathered . . . . . *Pediœcetes* 206

Tail stiffish, rounded, much shorter than wing, of 18 feathers; wing-like tufts and great bare space on neck. Tarsi scant-feathered . . . . . *Cupidonia* 207

Tail soft, rounded, about as long as wing, of 18 feathers; umbrella-like tufts on neck, but no obvious bare space. Tarsi bare below . . . . . *Bonasa* 208

Tail stiffish, flat, square, shorter than wing, of 16 or 20 feathers; no evidently peculiar feathers; bare space on neck. Tarsi full-feathered . . . . . *Canace* 204

Tail, etc., as in *Canace*. Tarsi and toes fully feathered. White in winter . . . . . *Lagopus* 209

204. CA'NACE. (Lat. *Canace*, a proper name.) Tree Grouse. Black Grouse. No obviously lengthened or otherwise peculiar feathers on neck or head. No *obviously* naked space on neck: but there is a piece of skin capable of distension, especially in the Western species of *Dendragapus*. A strip of bare colored skin over eye. No crest. Tarsi feathered to the toes. Tail little shorter than wing, stiffish, nearly square, of broad, obtuse feathers, normally 16 (in *Canace* proper) or 20 (in *Dendragapus*) in number. Of medium and large size, and dark blended colors, inhabiting woodland, like the species of *Bonasa*, and quite arboreal; northerly and alpine. Sexes distinguishable. Eggs heavily-colored.

Analysis of Subgenera, Species, and Varieties.

Tail normally of 16 feathers (exceptionally of 14 or 18, as an individual peculiarity). (*Canace* proper.)

Tail with broad orange-brown end, its upper coverts without white spots. Eastern . . *canadensis* 555

Tail without orange-brown end, its upper coverts with white spots. Western . . . . . *franklini* 556

Tail normally of 20 feathers (exceptionally 18 or 22 ?). (*Dendragapus*.) Western.

Tail black, with broad slate-colored end.

Under parts clear bluish slate color. Rocky Mts., etc., southerly . . . . . *obscura* 557

Under parts sooty plumbeous. Alaska . . . . . *fuliginosa* 559

Tail black, with narrow or no slate-colored end. Rocky Mts., etc., northerly . . . . . *richardsoni* 558

555. C. canaden'sis. (Of Canada. Fig. 397.) Canada Grouse. Spotted Grouse. Spruce Grouse. Spruce "Partridge." Adult cock: Head smooth, but feathers susceptible of erection into a slight crest. A colored comb of naked skin over the eye, bright yellow or reddish when fully injected. Tail slightly rounded, of 16 feathers, a scant inch broad to their very ends. Tarsi full-feathered to the toes, which are naked, scaly, and fringed. Tail black, broadly tipped with orange-brown; its upper coverts without decidedly white tips. Under parts glossy black, extensively varied with white; under tail-coverts tipped with white; sides and breast with white bars or semicircles; white spots bounding the throat; white spots on lore. Upper parts wavy — barred with black and gray, usually also with some tawny markings on the back and wings. In full feather, the appearance is of a black bird, grayer above, spotty with white

below, and orange tail-end. Length usually 16.00–17.00; wing 7.00; tail 5.50. Hen rather smaller. No continuous black below, where white and tawny, latter particularly on breast, nearly everywhere pretty regularly wavy-barred with blackish. Above, more like the male, but browner. End of tail more narrowly orange. Pullets resemble the hen. N. Am., E. of the R. Mts., northerly, in woodland. N. nearly or quite to the limit of trees; N. W. to Alaska. S. into the northern tier of States, especially Maine, Michigan, and Minnesota; casually to Massachusetts. It is a very hardy bird, enduring the rigors of sub-arctic winters, and not properly migratory. Eggs numerous, 1.68 × 1.20, rather pointed, buff-colored, dotted, spotted, and boldly splashed with rich chestnut. Shape and pattern of eggs more like those of ptarmigan than of the prairie grouse.

FIG. 397. — Canada Grouse, nat. size. (Ad nat. del. E. C.)

556. **C. c. frank'lini.** (To Sir John Franklin.) FRANKLIN'S SPRUCE GROUSE. Size, shape, and whole appearance of the foregoing. Tail rather longer, more nearly even, with broader feathers; lacking the terminal orange bar; tipped narrowly with white, its upper coverts tipped with white, making the upper side of the tail conspicuously spotty. Rocky and Cascade Mts., northerly, in U. S., and northward about sources of the Saskatchewan, Athabasca, and McKenzie Rivers. A mere variety of *C. canadensis:* the variation parallel with that of *C. richardsoni* as compared with *C. obscura.*

557. **C. obscu'ra.** (Lat. *obscura*, dark.) DUSKY GROUSE. BLUE GROUSE. GRAY GROUSE. PINE GROUSE. Old cock: Back and wings blackish-brown, finely waved and vermiculated in zigzag with slate-gray, mixed with more or less ochrey-brown and some white on the scapulars. Long feathers of the sides with white ends and shaft stripes; other under parts fine bluish-gray or light slate color, varied with white, especially on the lower belly, flanks, and vent-feathers. Cheeks black; chin and throat finely speckled with black and white. Though the lateral feathers of the neck are smooth and simple, forming no decided tufts as in *Cupidonia* or *Bonasa*, they are somewhat enlarged, covering a rudimentary tympanum: these feathers with snowy white bases and black tips. Tail brownish-black, veined and marbled with gray, and with a broad slate-gray terminal bar; of 20 feathers, broad to their very ends, the tail as a whole slightly rounded. Bill black; iris brown-orange; comb over eye. Size very variable; well-grown cocks usually 20, or 22 inches, sometimes up to 2 feet long; extent of wings about 30 inches; wing 9 or 10; tail 7 or 8. Hen smaller, and more motley, lighter colored and more extensively varied with white and tawny; but showing the distinctive slate-gray of the under parts, and the slate bar at end of the tail. Pullets like the hen, but the upper parts with hammer-headed white shaft-lines. Tail with white shaft-lines enlarged at the end, also marked on some of the feathers with wavy blackish crossbars. Rocky and other Mts., U. S., to the Pacific. A species of general dispersion in elevated and wooded, especially coniferous, regions of the West. S. to New Mexico, and in the White Mts. in Arizona; in the R. Mts. northerly shading into var. *richardsoni.* A large cumbrous bird, usually displaying stolidity or indifference to the presence of man, taking to trees when disturbed, and very easily slaughtered. Eggs larger, more elongated, and less heavily colored than those of spruce grouse and ptarmigan; creamy-buff, finely freckled all over with chocolate-brown, seldom with any large spots: 2.00 × 1.50.

558. **C. o. rich'ardsoni.** (To Sir John Richardson.) RICHARDSON'S DUSKY GROUSE. Size, shape, and whole appearance of the foregoing. Tail rather longer, more nearly even, with broader feathers, having the terminal slate bar reduced or wanting: general color more uniformly darker, black of throat more extensive. Rocky Mts., northerly, U. S. and northward.

A mere variety, only recognizable when fully developed: many intermediate specimens cannot be fairly referred to one rather than the other.

559. **C. o. fuligino'sa.** (Lat. *fuliginosa*, sooty.) SOOTY GROUSE. With the broad slate tail-bar of *obscura* proper, but colors darker than in *richardsoni* even. Above, blackish, minutely freckled with gray and rusty-brown: below, dark plumbeous. The hen is more different, with prevailing rich rusty and chestnut-brown markings. Northwest coast mountains, Oregon to Sitka.

205. **CENTROCER'CUS.** (Gr. κέντρον, *kentron*, a spine, prickle; κέρκος, *kerkos*, tail.) SAGE GROUSE. SPINE-TAIL GROUSE. Of great size. Tail very long, equalling or exceeding the wings, of 20 stiffened, narrow, acuminate feathers, much graduated in length. Neck susceptible of enormous distension by means of air-sacs covered with naked livid skin — not regularly hemispherical and lateral like those of *Cupidonia*, but forming a great protuberance in front of irregular contour; surmounted by a fringe of hair-like filaments, several inches long, springing from a mass of erect white feathers; covered below with a solid set of sharp white horny feathers, like fish-scales. (The affair is not easy to describe in few words, especially as it is constantly changing with the wear of the feathers, and is only fully exhibited by the cock during the amours. The anatomical arrangement for inflation is only a special exhibition of the air-sacs of other genera, as *Cupidonia* and *Pediœcetes*; the peculiarities of the feathers are the inherited results of habitual attrition, the birds rubbing the breast against the ground in their love-spasms; and, as said, the state of the parts is always changing with the wear of the feathers. This accounts for the vague or conflicting statements of authors.) Tarsus feathered to the toes. Digestive system remarkable for the slight muscularity of the gizzard, which is rather a membranous paunch than a grist-mill; the bird browses rather than scratches for a living, feeding on wormwood and also extensively on insects. Sexes similar in color, unlike in size and to some extent in form. One prairie species, perfectly terrestrial.

560. **C. urophasia'nus.** (Gr. οὐρά, *oura*, tail; φασιανός, *phasianos*, a pheasant.) SAGE COCK. SAGE HEN. COCK OF THE PLAINS. Largest of American Grouse. Full grown cock 2–2½ feet long; extent of wings 3 feet or more; wing and tail about a foot; weight upwards of 4 pounds. Hen a third smaller. Above, varied with black, gray, brown and buff; below, chiefly white, with a large squarish black area on the belly. To describe the peculiar neck-feathering of the old cock more particularly: On each side is a patch of feathers, meeting in front, with extremely stiff bases, prolonged into hair-like filaments some three inches in length; with the wearing away of these feathers in the peculiar actions of the bird in pairing-time, their hard horny bases are left, forming the "fish-scales" above said. In front of these peculiar feathers is the naked tympanum, capable of enormous inflation under amatory excitement. Above them is a tuft of down-feathers, covered with a set of long soft filamentous plumes corresponding to the ruff of *Bonasa*. Many breast feathers resemble the scaly ones of the neck, and are commonly found worn to a bristly "thread-bare" state. Scaly bases of the feathers soiled white; the thready ends blackish; the fluffy feathers snowy-white, like wool, the longer overlying filamentous plumes glossy black. Chin and throat blackish, speckled with white ends of the feathers, usually presenting a definite white half-collar. Lining of wings white. Hen: Length about 20 inches; wing 10 inches; tail 7 or 8, of same general character as the cock's, but softer, shorter, less cuneate, with more rapidly tapering feathers. A small tympanum, but no obviously peculiar feathers on neck. Coloration quite like that of the cock. Pullet: No peculiar neck-feathers; tail beginning to show its special form; general coloration of the hen. Before the September moult, all the feathers of the upper parts with sharp white hammer-headed shaft lines, and circular spotting of the feathers of the breast. Sooty belly-patch showing with the first feathering. Chick in down altogether different from the dingy yellow chick of *Pediœcetes*; below grayish-white, above gray-brown mottled with black; bill black. This remarkable bird, quite a Roland for the Capercaillie's Oliver, inhabits the

sterile sage-bush plains of the West; an abundant and characteristic species of those forbidding regions, beginning with the Eastern slopes and foot-hills of the R. Mts., South into New Mexico and Arizona, sparingly N. to 49° or slightly further, in the Milk River region. Not in Dakota east of the Coteau, or in the Missouri Basin much below the Yellowstone country. Its centre of abundance is the artemisia tracts of Colorado, Wyoming, Utah, Nevada, Idaho, Eastern California, and Oregon. It straggles through the sage-bush, but I have seen packs of hundreds in the fall. In the breeding season its sonorous hullaballoo resounds on every hand where the birds are numerous. The flesh is edible or not, "as you like it." The behavior towards man varies with circumstances; sometimes the birds may almost be knocked over with a stick, at others it is difficult to get a shot. In walking, the tail is somewhat elevated, and swings sideways with each step. The flight is extremely vigorous, and at times greatly protracted, with wings so widely expanded that the tips of the primaries stand apart; the course rapid and steady when the bird is once fairly on wing, accomplished with a succession of quick energetic wing-beats, alternating with sailing with stiffly motionless wings until the impulse is spent. From the nature of its resorts the bird is exclusively terrestrial. The egg is narrower and more pointed than that of any other grouse of our country, measuring from 2.05 to 2.25 in length by 1.50–1.60 in breadth; grayish or greenish-drab color, thickly speckled with chocolate-brown, mostly in minute dots evenly distributed, occasionally with well-defined spots up to the size of a split pea, tending to circular shape.

206. **PEDIŒCETES.** (Gr. πεδίον, *pedion*, a plain; οἰκέτης, *oiketes*, an inhabitant.) PIN-TAIL GROUSE. Neck without obviously peculiar feathers, like those either of the pinnated or ruffed grouse or sage cock, but with a hidden, definitely circumscribed space on each side of reddish, vascular, and distensible skin, constituting an undeveloped tympanum, over which lies a lateral series of slightly enlarged feathers. Head lightly crested, the longest feathers of the crown falling on the occiput; a crescentic naked patch over each eye of numerous orange or chrome-yellow fringe-like processes, in several parallel curved rows. Feet full-feathered to between the bases of the toes, with long, hair-like plumage reaching to or beyond the end of the hind claw; toes above with one row of broad, transverse scutella, a row on each side of smaller rounded scales, and a conspicuous fringe of horny processes; below, bossed and scabrous. Tail much shorter than the wings, normally of 18 true rectrices, of which the central pair are soft, parallel-edged and square-tipped, projecting an inch or two beyond the next pair; the rest rapidly graduated, stiffish, and crisp (making a creaking sound when rubbed together); at first about straight-edged, soon becoming club-shaped (with a constriction near the apex) by mutual attrition. Sexes similar, but cock rather larger and darker than the hen, with more prominent supraciliary papillæ. One species, of two varieties, of prairie, perfectly terrestrial.

Analysis of Varieties.

Northern Sharp-tailed Grouse. The markings black, white and dark brown, with little or no tawny; spots on the under parts numerous, blackish, V-shaped; throat white, speckled. (Arctic America.) *phasianellus* 561

Common Sharp-tailed Grouse. The markings black, white, and especially tawny; below, the spots fewer, brown, U-shaped; throat buff. (U. S. and adjoining British Province.) . . . . . *columbianus* 562

561. **P. phasianel'lus.** (Diminutive of Lat. *phasianus*, a pheasant.) NORTHERN SHARP-TAILED GROUSE. As above, in comparison with the ordinary bird next described. Very dark-colored, in blackish and white variegation, with little buff, even in the fall. The markings below heavier, in sharper, more arrow-headed shape, quite blackish. The feet very heavily feathered, almost like a ptarmigan's. Interior of British America, E. to Hudson's Bay, N. and W. to the Yukon, southward shading directly into the U. S. bird, before reaching 49°. This is the true *Tetrao phasianellus* — a name commonly applied to the next variety.

562. **P. p. columbia'nus.** (Of the Columbia River. Fig. 398.) COMMON SHARP-TAILED GROUSE. PRAIRIE CHICKEN OF THE NORTHWEST. Adult ♂ ♀ : Upper parts closely and pretty evenly

variegated with blackish-brown, reddish-brown, and grayish-brown, the pattern smallest on the rump and lower back, where the blackish is mostly in sharp-angled stars; the reddish most conspicuous on the upper back, and both the lighter colors everywhere finely sprinkled with blackish. Wing-coverts like the upper back, but with numerous conspicuous rounded white spots, one on the end of each feather. Crown and back of neck nearly like the back, but in smaller pattern, and the markings mostly transverse. An illy-defined white area on each side of the neck, over the tympanum, and slight whitish stripe behind the eye. Throat fine light buff, usually immaculate, but sometimes finely speckled quite across. Under parts white, more or less tinted with buff toward the throat; the breast with numerous regular dark-brown U-shaped spots, one on each feather; similar but smaller, sharper, and fewer such spots thence scattered over most of the under parts, only the middle of the belly being left unmarked. Long feathers of the sides under the wings matching the upper wing-coverts nearly; under wing-coverts and axillaries pure white, not marked; flanks with bars or U-spots of dark brown. Legs grayish-white, unmarked. Quills of the wings fuscous; outer webs of the secondaries with equidistant, squarish, white or tawny spots, the secondaries tipped and imperfectly twice or thrice barred with white, and gradually becoming sprinkled with the varied colors of the back, so that the innermost of them are almost precisely like the greater coverts. Four middle tail-feathers variegated, much like the back; others white, or grayish-white, on the inner webs, the outer webs being mottled; a few under tail-coverts spotted, the rest white; upper tail-coverts nearly like the rump. Iris light brown; bill dark horn-color; part of under mandible flesh-colored; claws like bill; toes on top light horn-color, the soles darker. Length, 18 or 20 inches; extent 24 to 30; wing 8 to 9; middle tail-feathers 4 to 6; shortest tail-feathers (outermost), about $1\frac{1}{2}$; tarsi, 2 inches; middle toe and claw about the same; culmen of bill about $\frac{5}{8}$; gape of bill 1 to $1\frac{1}{4}$; depth of bill at base $\frac{1}{2}$ or rather less. Pullets, before first moult: Crown bright brown, varied with black. Sharp white shaft-lines above, which, with a black area on each feather, contrast with the fine gray and brown mottling of the upper parts. Wing-coverts and inner quills with whitish spots. Several inner tail-feathers with whitish shaft lines, and mottled with blackish and brown. Lower throat and breast with numerous dark brown spots; sides similar, the markings lengthening into streaks. Bill brown above, pale below. This lasts till the September moult is completed. Chicks hatch dingy yellow, mottled on the crown, back, and wings with brown and black. The Pin-tail Chicken inhabits the western portions of Minnesota, a small part of Iowa, all of Dakota, thence diagonally across Nebraska and Kansas to Colorado in the Laramie and upper Platte regions; thence westward in suitable country to the Sierra Nevada and Cascade Ranges; northern limit to be conventionally established along the N. border of the U. S., beyond which it shades into the true *phasianellus*. In fine, this is the prairie chicken of the whole Northwest; usually occurring where *C. cupido* does not, the two

FIG. 398. — Head of Sharp-tailed Grouse, nat. size. (Ad nat. del. E. C.)

overlap to some extent. Formerly ranged in all the prairie of Minnesota, Michigan, and Iowa, but is pushed westward by the grain-fields — the same carrying *cupido* along. Eggs 5–10–12–13, in June; grayish-olive or drab-colored, uniformly dotted with brown points, rarely larger than a pin-head; always quite different from those of *cupido;* 1.60 to 1.80 long by 1.20 to 1.30 broad; average 1.75×1.25. A fine game and table bird, in all respects like *cupido.*

207. **CUPIDO'NIA.** (Name derived from *cupido*, which see below.) PIN-NECK GROUSE. Neck with a peculiar tuft on each side of loose, lengthened, acuminate feathers, like little wings beneath which is a circular patch of bare, yellow skin, capable of great distension, like the half of a small orange. Head with a slight soft crest. Tarsi scant-feathered to the toes in front and on sides, bare on a strip behind; toes extensively webbed at base. Tail short, rounded, of 18 broad stiffish feathers, with obtusely rounded ends. Sexes nearly alike in size, form, and color; plumage below barred transversely. One species, 2 varieties, of prairie, perfectly terrestrial.

FIG. 399. — Foot of Prairie Hen, nat. size. (Ad nat. del. E. C.)

Analysis of Varieties.

THE COMMON BIRD. Tarsal feathers hiding the bare strip. Dark bars above black, and broad; top of head mostly blackish . . . . . *cupido* 563

TEXAS BIRD. Tarsi very scant-feathered, the bare strip exposed. Dark bars above brown and narrow; top of head little blackish . . . . . *pallidicinctus* 564

563. C. cupi'do. (The tufts on the neck likened to conventional "cupid's wings." Figs. 399, 400.) PINNATED GROUSE. PRAIRIE HEN. ♂ ♀: Above, variegated with black, brown, tawny, or ochrey, and white, the latter especially on the wings; below, pretty regularly barred with dark brown, white, and tawny; throat tawny, a little speckled, or not; vent and crissum mostly white; quills fuscous with white spots on the outer webs; tail fuscous, with narrow or imperfect white or tawny bars and tips; sexes alike in color, but ♀ smaller, with shorter neck tufts. Length 16.00–18.00; extent about 28.00; wing 8.00–9.00; tail about 4.50; tarsus rather over, middle toe and claw rather under, 2.00; neck-tufts 2.00–3.50 inches long. This well-known bird formerly ranged across the United States.

FIG. 400. — Prairie Hen. (From Lewis.)

in open country, from the Atlantic to the Eastern foot-hills of the R. Mts., in some latitudes, and now abounds on the prairies, from Illinois and Wisconsin, to Middle Kansas at least, if not found on the dryer plains westward. Its usual range includes Illinois, Iowa, Missouri, Eastern half of Minnesota, Southeastern Dakota, Middle and Eastern Kansas and Nebraska, Arkansas, and Eastern Texas. It is creeping westward with the grain fields. Ten years ago it mixed with the sharp-tails about St. Paul's, Minnesota, and up the Missouri to beyond Sioux City. The line of railroad is a favorite highway for the birds. It has been almost extirpated in the Middle and Eastern States, though it still occurs sparingly in isolated localities in New York, New Jersey, Pennsylvania, Long Island, Nantucket, and Martha's Vineyard, etc. Its abundance, and the excellence of its flesh, render it an object of commercial importance. Though there may be little probability of its extinction, legislation against its wanton or ill-timed destruction is a measure of obvious propriety. Eggs averaging shorter, rounder, and smaller than those of the sharp-tail: pale greenish-gray, with sometimes a glaucous bloom, usually unmarked, sometimes very minutely dotted with brown

FIG. 401. — Head of Ruffed Grouse, nat. size. (Ad nat. del. E. C.)

564. C. c. pallidicinc'ta. (Lat. *pallidus*, pale: *cinctus*, begirt.) PALE PINNATED GROUSE. Above, the dark markings not in excess of the lighter markings, and rather brown than black; below, the dark bars very pale and narrow. Tarsi scant feathered, exposing the bare strip behind. Southwestern prairies; a local race, from warmer and dryer regions.

208. BONA'SA. (Gr. *βόνασος*, Lat. *bonasus*, a bison: the "drumming" of the bird being likened to the bellowing of a bull.) RUFFED GROUSE. Head with a full soft crest. Neck on each side with a tuft of numerous (15–30) broad soft glossy-black feathers, covering the rudimentary tympanum. Tail about as long as the wings, amply rounded or fan-shaped, normally of 18 soft broad feathers, with truncate ends. Tarsi scantfeathered, naked below, with two or three rows of scutella in front. Plumage of blended and varied colors: sexes alike. Woodland species, more or less arboreal, of common occurrence in suitable places.

FIG. 402. — Ruffed Grouse. (From Lewis.)

Analysis of Varieties.

Brown, of mixed and varied shades of reddish and gray. Eastern and Northern . . . . . *umbella* 565
Pale; slaty-gray the prevailing shade. Rocky Mountain region . . . . . *umbelloides* 566
Dark; chestnut-brown the prevailing shade. Pacific Coast region . . . . . *sabinii* 567

565. B. umbel'la. (Lat. *umbella*, an umbel, umbrella; *umbra*, shade, shadow; alluding to the neck-tufts. Figs. 401, 402.) RUFFED GROUSE. "PARTRIDGE;" New England. "PHEASANT;" Middle and Southern States. ♂ ♀: Above, variegated reddish- or grayish-brown, the back with numerous, oblong, pale, black-edged spots. Below, whitish, barred with brown. Tail brown or gray, numerously and narrowly black-barred, with a broad subterminal black zone, and tipped with gray. The neck-ruffle of the ♂ mostly glossy black, and very full; of the ♀ smaller and more brown. The colors are endlessly varied as well as blended, and the prevailing tone of the brown birds of the East shades insensibly into that of the Western varieties. Length 16.00–18.00; extent 23.00; wing 7.00–8.00; tail about the same. A woodland bird, like the species of *Canace*, abundantly distributed over Eastern North America; in the U. S. to the central plains; in Brit. Am. to Alaska. It is well known under the above names in different sections; but it is neither a "partridge" nor a "pheasant," being, in fine, a Ruffed Grouse. The "drumming" sound for which this bird is noted, is not vocal, as some suppose, but is produced by rapidly beating the wings. Eggs very characteristic, from creamy white to creamy buff, usually immaculate, sometimes minutely dotted or even speckled with brown; they resemble partridge eggs also in shape, which approaches the pyriform, broad and blunt at one end, pointed at the other; size about 1.66 × 1.20.

566. B. u. umbelloï'des. (Lat. *umbella*, as above defined, and Gr. *εἶδος*, *eidos*, resemblance.) GRAY RUFFED GROUSE. A variety of the last, of very different tone of color in its extreme development, but shading into the common Ruffed by insensible degrees in Brit. Am. When fully manifested, as follows: Lower back, rump, upper tail-coverts and tail slate-gray, with little if any brown tinge; the feathers of the back and rump with light gray cordate or arrow-headed spots narrowly bordered with black, the tail-feathers finely vermiculated with black, and with a broad subterminal black zone. Ruffle glossy greenish-black. Under parts whitish, more or less tinged with tawny-brown, with several broad brown cross-bars on each feather, largest and most distinct on the long feathers of the sides, some of which have also white shaft lines; heavy feathers of flanks and vent mostly whitish, unmarked. Feathers of fore-neck and scapulars blended with gray, rich reddish-brown, ochrey-brown, and white, in indescribable confusion. Most of the wing-coverts with white shaft-lines. Hen with the ruffle less developed, varied with brown and white. General tone more rufous than in the cock. Rocky Mt. region, U. S., running into both the other varieties.

567. B. sabi'nii. (To J. Sabine.) RED RUFFED GROUSE. OREGON RUFFED GROUSE. More nearly resembling the common ruffed grouse, but the coloration more heavily brown, — darker and richer. More blackish to the brown, and the latter almost chestnut in well-marked cases. Pacific coast region, Oregon to Alaska.

209. LAGO'PUS. (Gr. *λαγώπους*, *lagopous*, Lat. *lagopus*, hare-foot: the densely-feathered feet resemble those of rabbits.) PTARMIGAN. SNOW GROUSE. No peculiar feathers on head or neck. Tarsi and toes densely feathered. Tail short, little rounded, normally of 14 broad feathers, with long upper coverts, some of which resemble rectrices, the central pair of these usually reckoned as rectrices, making 16. A naked red comb over eye. Boreal and alpine grouse, shaped nearly as in *Canace*, remarkable for the seasonal changes of plumage, becoming in winter snow-white (excepting the British insular race). There are only five or six species, at most, and probably fewer; we certainly have the three here given.

Analysis of Species.

Tail black at all seasons.
- The summer plumage mostly rich chestnut or orange-brown, and black. In winter, no black stripe on head. Bill stout . . . . . *albus* 568
- The summer plumage wholly brownish-yellow and black, except on wings and tail. In winter a black stripe on head. Bill slender . . . . . *rupestris* 569

Tail white at all seasons.
- The summer plumage ochrey-brown and black. In winter entirely white . . . . . *leucurus* 570

568. L. al'bus. (Lat. *albus*, white. Figs. 403, 404.) Willow Grouse. Willow Ptarmigan. Bill very stout and convex, its depth at base as much as the distance from nasal fossa to tip; whole culmen 0.75; bill black at all seasons. ♂ ♀, in winter: Snow white; 14 tail-feathers black, white-tipped; the middle pair (which most resemble and perhaps are true rectrices, having no after-shafts) together with all the coverts, one pair of which reach to end of tail, white; shafts of several outer wing-quills black; no black stripe on head. ♂, in summer: The head

Fig. 403. — Willow Ptarmigan, summer plumage, ⅓ nat. size. (From Brehm.)

and fore parts rich chestnut or orange-brown, more tawny-brown on back and rump; the richer brown parts sparsely, the tawny-brown more closely, barred with black; most of the wings and under parts remaining white. ♀ similar, wholly colored excepting the wings, the color more tawny than in the ♂, and more heavily, closely, and uniformly barred with black. Length 15.00–17.00; wing about 8.00; tail 5.50. Arctic and Northern N. Am. from ocean to ocean, into the northernmost U. S. Eggs very heavily colored, with bold confluent blotches of intense burnt sienna color, upon a more or less reddish-tinted buff ground. All the eggs of birds of this family are colorless when the shell first forms high in the oviduct, acquiring pigment as they pass down; in the ptarmigan, where the coloring is so heavy, an egg cut from the pigment-

secreting part of the passage is as if covered with fresh paint, soft and sticky, which may be rubbed off before it "sets" on the shell. Size 1.80 × 1.20.

569. L. rupes'tris. (Lat. *rupestris*, relating to *rupis*, a rock; rupestrine.) ROCK PTARMIGAN. Bill slenderer for its length than that of *L. albus*, its depth at base less than the distance from nasal fossa to tip; whole culmen 0.67; bill always black. ♂ ♀, in winter: As in *L. albus*, but a black transocular stripe on side of head. ♂ ♀, in summer: The whole plumage, excepting the wings and tail, barred with blackish-brown and brownish-yellow. Rather smaller than the

FIG. 404. — Willow Ptarmigan, winter plumage, ¼ nat. size. (From Brehm.)

foregoing. Length 14.00–15.00; wing 7.00–7.50; tail 4.50. Arctic America, not S. to the U. S. Eggs 13–15 or more, like those of *L. albus*, but darker and rather smaller; size 1.70 × 1.18. "The summer plumage is assumed at variable periods of the months of April, May, and even in early June, according to the locality. The moult for the summer is usually shown first on the head and neck, followed by the lower back, sides, breast, middle back, flanks, and abdomen, in the order named. The abdomen and chin are the last areas to show the complete moult. The parts named also assume, in the order given, the white winter plumage. During the time of the summer plumage scarcely a single day passes that the general color of the feathers is not modified by the appearance or loss of some feather." (*Turner.*) Hence the difficulty if not impossibility of establishing races of this species upon color, as the amount of barring, vermiculation, or nebulation with dusky, tawny, and gray is incessantly changing in

the same individuals; and birds taken at different dates in the summer, in the same locality, may differ from one another more than specimens from different regions, representing several alleged varieties, are always found to do. The American bird, in fact, is scarcely distinguishable from the European *L. mutus* or *alpinus*. The Greenland bird has been called *L. reinhardti* by Brehm. That of the Aleutian Islands, *L. mutus atkensis*, Turner. The latter is said to have the bill and claws about 0.10 longer than usual.

570. L. leucu'rus. (Gr. λευκός, *leucos*, white; οὐρά, *oura*, tail. Fig. 405.) White-tailed Ptarmigan. Rocky Mountain Snow Grouse. ♂ ♀, in winter: Entirely snow-white; bill black, rather slender, and general size and proportions nearly as in *L. rupestris*. ♂ ♀, in summer: Tail, most of the wing, and lower parts from the breast, remaining white; rest of the plumage minutely marked with black, white, and tawny or grayish-brown, varying in precise character almost with every specimen; but there is no difficulty in recognizing this white-tailed species, of alpine distribution in Western N. A. from the Arctic regions to New Mexico (lat. 37°). In summer, inhabits the mountain ranges from timber-line to the highest peaks, in winter ranging lower down. Eggs very different from the heavily-painted ones of *L. albus*, of dull creamy complexion, minutely dotted over the whole surface with burnt-sienna, few of the markings exceeding a pin's head in size, and not thick enough to obscure the ground-color; shape purely ovoidal, greatest diameter near the middle; size 1.70 × 1.14; number variable, about a dozen.

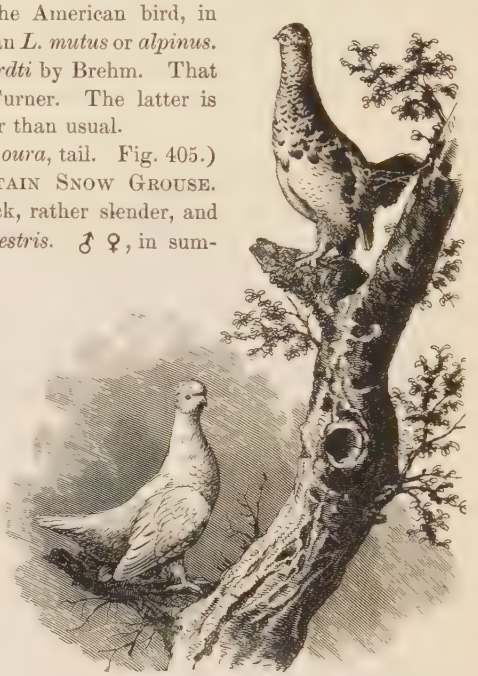


Fig. 405. — White-tailed Ptarmigan; upper, in summer; lower, in winter. (From Hayden.)

53. Subfamily ODONTOPHORINÆ: American Partridges and Quails.

Fig. 406. — European Partridge. (From Dixon.)

Head completely feathered, and usually crested, the crest frequently assuming a remarkable shape. Nasal fossæ not filled with feathers, the nostrils covered with a naked scale. Tarsi and toes naked, the latter scarcely or not fringed, the former scutellate. Size smaller than in *Tetraoninæ*.

Our Partridges may be distinguished, among American *Gallinæ*, by the foregoing characters, but not from those of the Old World; and it is highly improbable that, as a group, they are separable from all the forms of the latter by any decided peculiarities. The principal supposed character, namely, a toothing of the under mandible, is very faintly indicated in some forms, and entirely wanting in others. Pending final issue, however, it is expedient to recognize the group, so strictly limited geographically, if not otherwise. Several beautiful and important genera occur within our limits, but these Partridges are most numerous in species in Central and South America. *Odontophorus* is the leading genus, with perhaps 15 species; *Eupsychortyx* and *Dendrortyx* are other extra-limital forms; and in all, some

forty-odd species are known. In habits, they agree more or less completely with the well known Bob-white. Our species are apparently monogamous, and go in small flocks, called "coveys," usually consisting of the members of one family; they are terrestrial, but take to the trees on occasion; nest on the ground, laying numerous white or speckled eggs; are chiefly granivorous, but also feed on buds, soft fruits, and insects; and are non-migratory.

Analysis of Genera.

An inconspicuous crest, scarcely visible except in life. Tail about $\frac{2}{5}$ as long as the wing. Coloration everywhere variegated. (One species) . . . . . *Ortyx* 210

A short, soft, full crest. Tail $\frac{1}{3}$ the wing. Coloration much the same all over, showing curious semi-circular markings. (One species) . . . . . *Callipepla* 213

A long, slender, arrowy crest, two or three inches long, of two narrowly linear feathers. Tail $\frac{2}{3}$ as long as the wing. Parti-colored, but the coloration chiefly in masses. (One species) . . . . . *Orortyx* 211

A long, recurved, helmet-like crest, of several imbricated plumes, enlarged at the extremity. Tail $\frac{2}{3}$ as long as the wing. Coloration chiefly in masses. (Two species) . . . . . *Lophortyx* 212

A short, soft, full crest. Tail scarcely $\frac{1}{2}$ as long as the wing. Coloration peculiar, in round, white spots on the under parts of the ♂. (One species). . . . . *Cyrtonyx* 214

As all these genera have each but a single species in this country, excepting *Lophortyx*, the foregoing is nearly equivalent to a determination of the species.

210. **ORTYX.** (Gr. ὄρτυξ, *ortux*, a quail.) Feathers of crown lengthened and erectile, but hardly forming a true crest. Tail about $\frac{2}{5}$ as long as the wing. Outstretched feet reaching beyond end of tail. Coloration much variegated; a reddish-brown varied with black and white the leading color. Eggs white, pyriform, numerous.

FIG. 407. — Bill and foot of *Ortyx*, nat. size. (Ad nat. del. E. C.)

Analysis of Varieties.

Length of ♂, 10 inches or rather more; extent 15 or more; wing 4.50 or more. Bill blackish-brown. Ground color dull pinkish-red with narrow black bars below . . . . . *virginiana* 571

Length of ♂, scarcely 10 inches; extent under 15; wing scarcely or not 4.50. Bill jet black. Ground color dark reddish, with much broader black bars below . . . . . *floridana* 572

Length etc. as in *floridana*. Ground color paler than in *virginiana*, with numerous black bars, and increase of ashy and tawny . . . . . *texana* 573

FIG. 408. — Mr. and Mrs. Bob White, nat. size. (Ad nat. del. E. C.)

571. **O. virginia'na.** (Of Virginia. Figs. 407, 408, 409.) VIRGINIA PARTRIDGE, or "QUAIL." BOB-WHITE. "QUAIL:" New England, wherever the Ruffed Grouse is called "partridge."

"PARTRIDGE:" Southern and Middle States, wherever the Ruffed Grouse is called "pheasant." ♂: Forehead, superciliary line, and throat, white, bordered with black; crown, neck all round, and upper part of breast, brownish-red; other under parts tawny-whitish, all with more or fewer doubly-crescentic black bars; crissum rufous; sides broadly striped with brownish-red; upper parts variegated with chestnut, black, gray and tawny, the latter edging the inner quills, forming a continuous line when the wing is closed. ♀: Known by having the throat buff instead of white, less black about the fore-parts, and general coloration subdued. The reddish of this bird is of a peculiar dull pinkish shade. The black crescents of the under parts are scarcely or not half the width of the intervening white spaces; the bill is not jet black. Length of ♂ 10.00–10.50;

FIG. 409. — The Bob White family. (From "Sport with Gun and Rod;" The Century Co., N. Y.)

extent 15.00–15.50; wing 4.50 to nearly 5.00; tail 2.75-3.00. ♀ 9.50–10.00; extent 14.50–15.00; wing 4.25-4.50; tail 2.50–2.75. Among the thousands of Bob-whites yearly destroyed, albinotic or melanotic, and other abnormally colored specimens, are frequently found; but the percentage of these cases is nothing unusual, and the sportsman must be cautioned against supposing that such birds have any status, in a scientific point of view, beyond their illustration of certain perfectly well known variations. Such specimens, however, are interesting and valuable, and should always be preserved. Eastern United States. North to Massachusetts and slightly beyond; Canada West; Minnesota. West to high central plains. Up the Missouri to White River. Salt Lake Valley (introduced). The characteristic game bird of this country. Eggs indefinitely numerous, pure white, pointed at one end and very blunt at the other, about 1.30 × 1.00.

572. O. v. florida/na. (Of Florida.) FLORIDA QUAIL. Rather smaller, the ♂ about the size of the ♀ *virginiana*, but bill relatively larger, and jet-black; colors darker, all the black markings heavier, those of the under parts nearly as broad as the intervening white spaces. Florida, and similar specimens in the lower Mississippi Valley; an approach to the Cuban form (*O. cubanensis*).

573. O. v. texa/na. (Of Texas.) TEXAS QUAIL. Size of *floridana;* colors paler, the prevailing shade rather gray than brown; upper parts much variegated with tawny. Eggs 1.20 × 0.93. These two are mere climatic varieties of one species.

211. ORORTYX. (Gr. ὄρος, *oros*, a mountain; ὄρτυξ, *ortux*, a quail.) PLUMED QUAIL. Head adorned with an arrowy crest of two slender keeled plumes, 3-4 inches long in the ♂ when full-developed; present in ♀, shorter. Bill and feet stout; tarsus equal to the middle toe and claw. Tail about ⅔ the wing, broad, rounded, with long coverts. Size large; colors massed in large areas; sexes alike. Eggs colored. One species.

574. O. pic'ta. (Lat. *picta*, pictured, painted. Fig. 411.) PLUMED PARTRIDGE. MOUNTAIN QUAIL of the Californians. ♂ ♀, adult: Back, wings and tail olive-brown, the inner secondaries and tertiaries bordered with whitish or tawny, forming a lengthwise border in single line when the wings are folded; the primaries fuscous, the tail-feathers fuscous, minutely marbled with the color of the back. Fore-parts, above and below, slaty-blue (above more or less glossed with the olive shade of the back, below minutely marbled with black); the throat chestnut, immediately bordered laterally with black, then framed in a firm white line, broken through the eye, reappearing around base of under mandible. Extreme forehead whitish. The arrow-plumes black. Belly chestnut, the sides banded with broad bars of black and white, or rufous-white; middle of the lower belly, tibia, and flanks, whitish or rufous; crissum velvety-black, streaked with chestnut. Bill dusky, paler below; feet brown. Length 11.00–12.00; extent 16.00–17.00; wing 5.00–5.50; tail 3.00–3.50; tarsus 1.67; middle toe and claw about the same. An elegant species, much larger and more beautiful than the Bob-white, inhabiting the mountainous parts of Oregon, California and Nevada. The relative extent of the olive and slaty parts is very variable. There is something of a grouse in the composition of this partridge. Egg a miniature of the ruffed grouse's, only distinguished by smaller size — 1.40 × 1.10.

FIG. 410. — Helmet Quail (*L. gambeli*). nat. size. (Ad nat. del. E. C.)

FIG. 411. — Plumed Quail. (From Tenney, after Audubon.)

212. LOPHORTYX. (Gr. λόφος, *lophos*, a crest; ὄρτυξ, *ortux*, a quail.) HELMET QUAIL. With an elegant crest, recurved helmet-wise, of several (6–10) keeled, clubbed, glossy-black, imbricated feathers, more than an inch long when fully developed; in the ♀, smaller, of fewer feathers. Tarsus slightly shorter than middle toe and claw. Tail about ⅔ as long as the wing;

outstretched feet not reaching to its end. Bulk of the Bob-white, but longer; 10.00–11.50; wing 4.00 or more; tail 3.00 or more. Coloration chiefly in masses; sexes unlike. ♂ with the chin and throat jet-black, sharply bordered with white; a white line across the vertex and along the sides of the crown, bordered behind by black; ♀ without these head-markings. Eggs colored. Two elegant species in the U. S.

Analysis of Species.

♂ middle of belly orange-chestnut; sides like back, with white stripes; hind-head smoky-brown; fore-head chiefly whitish, with white loral line . . . . . *californica* 575

♂ middle of belly jet-black; sides chestnut with white stripes; hind-head chestnut; fore-head chiefly black; no white loral line . . . . . *gambeli* 576

Fig. 412. California Helmet Quail, ½ nat. size. (From Brehm.)

575. L. califor'nica. (Lat. Californian. Fig. 412.) CALIFORNIAN PARTRIDGE. VALLEY QUAIL of the Californians. ♂: With a small white line from bill to eye; forehead whitish with black lines; occiput smoky-brown; nuchal and cervical feathers with very dark edging and shaft-lines, and fine whitish speckling. General color of upper parts ashy, with strong olive-brown gloss, the edging of the inner quills brownish-orange. Fore breast slaty-blue; other under parts tawny, deepening centrally into rich golden-brown or orange-chestnut, all the feathers sharply edged with jet-black; sides olive-ashy like the back, with sharp white stripes; vent, flanks, and crissum tawny, with dark stripes. Length 10.00–11.00; wing 4.25; tail 3.75; tarsus 1.25; middle toe and claw rather more. Besides lacking the definite head-markings, the ♀ wants the rich sienna color of the under parts, which are whitish or tawny with black semicircles

as in the ♂; the breast is olive-gray. The changes of plumage are parallel with those of *L. gambeli*. Lower portions of California and Oregon; E. nearly to the Colorado River; abundant. A fine species, entirely distinct from the next, but habits and manners in all respects the same; replaces *L. gambeli* westward. Eggs speckled, as in the next.

576. **L. gam'beli.** (To Wm. Gambel. Fig. 410.) GAMBEL'S PARTRIDGE. ARIZONA QUAIL. ♂: Without white loral line; forehead black with whitish lines; occiput chestnut; nuchal and cervical feathers with dark shaft lines, but few dark edgings or none, and no white speckling. General color of upper parts clear ash, the edging of the inner quills white. Fore-breast like the back; other under parts whitish, the middle of the belly with a large jet-black patch; sides rich purplish-chestnut, with sharp white stripes; vent, flanks and crissum white with dusky streaks. Bill black; iris brown. Besides lacking the definite head-markings, the ♀ wants the black abdominal area, where the feathers are whitish with dark lengthwise touches; crest dark brown, not recurved, and fewer-feathered than that of the cock. Top of head grayish-brown, nearly uniform from bill to nape; throat grayish-white with slight dark pencilling. Chicks, in the down: Bill above reddish, nearly white below; feet dull flesh-color. Head dingy yellowish, with a large brown spot on the occiput, a few black, white-streaked feathers on crown, and the crest sprouting in a week or two. Upper parts grayish-brown mottled with black spots, and conspicuously striped with white lines. Outer webs of the sprouting quills marked with blackish and whitish. Throat white; other under parts narrowly barred with black and tawny-white, striped lengthwise with pure white. Sprouting tail-feathers like the primaries. Pullets, quarter-grown, 6–7 inches long: Leaden-gray, becoming tawny on the wings, which are still a little mottled as above described; below, light gray, nearly white on throat and belly. Breast waved with light and dark gray, with traces of the white stripes. Sides under the wings slightly fulvous or rufescent, but without definite stripes. Quills plain dusky; tail-feathers more plumbeous, marked with blackish and whitish. A broad white superciliary line. With the progress of the fall moult this dress changes for one like that of the adults, and the sexes are soon distinguishable. Eggs 1.25×1.00, pyramidal, narrow and pointed at one end, very obtuse the other; color buff or rich creamy, dotted and spotted all over with bright brown, splashed here and there with large blotches of the same; number indefinite — 8–12 or more. Nest like that of any other partridge. New Mexico and Arizona, both in mountains and valleys, very abundant; E. to Pecos and San Elizario, Texas, beyond which replaced by the Massena partridge; W. to Colorado R. and slightly beyond; N. to Utah; S. into Mexico. The characteristic game bird of Arizona.

213. **CALLIPEP'LA.** (Gr. καλλιπέπλος, *kallipeplos*, beautifully arrayed.) SHELL QUAIL. General character of *Lophortyx*, but head with a short, full, soft crest as in the Massena quail (fig. 413). Coloration of under parts producing a shelly or scaly appearance. Sexes nearly alike. Eggs not heavily colored. One U. S. species.

577. **C. squama'ta.** (Lat. *squamata*, squamous, scale-like.) SCALED PARTRIDGE. BLUE QUAIL. ♂, adult: General color bluish-plumbeous, shading into olive-brown on the back and wings and to rufous on the under parts behind the wings, with a large abdominal area of orange-brown; the feathers of the neck all around, and most of those of the under parts, sharply edged with black, producing a peculiar shell-like appearance; on the breast the feathers also with concealed reddish shaft-lines. Long feathers of the sides like the back in color, with white brown-edged stripes or long-oval spots. On the flanks and crissum the feathers lose the scaly appearance, becoming blended rusty-brown, with linear, sagittate, or cordate dark spots. Inner secondaries edged with buff or whitish, affording to the folded wing the lengthwise stripe so characteristic of N. A. partridges. Quills plain fuscous; tail-feathers plumbeous. No definite stripes about the head; crest dark brown ending in pure white. Length 10.00–11.00; extent 14.50–15.50; wing 4.50; tail 3.50; tarsus 1.25; middle toe and claw 1.04. ♀ little different; head markings the same; the orange-brown of the belly

reduced or wanting; size rather less. Texas, N. M., Ariz. and southward: generally dispersed, but far less numerous than the top-knot quails, and apparently more southern; extends along the Rio Grande to about 100 miles from the coast. Eggs 10–12–16, rather elliptical than conical, 1.25×0.98, white, minutely freckled with buff.

214. **CYRTO'NYX.** (Gr. κυρτός, *kurtos*, bent, crooked; ὄνυξ, *onux*, nail, claw.) HARLEQUIN QUAIL. Bill very stout. Head with a full, soft, depressed occipital crest. Tail very short, soft, almost hidden by the coverts, scarcely or not half as long as the wings. Wing-coverts and inner quills highly developed, folding entirely over the primaries. Feet small; tarsus rather shorter than middle toe and claw; toes short, but with remarkably developed claws. A very distinct genus. Plumage of head of ♂ curiously striped; of under parts ocellated. Sexes very unlike.

578. **C. masse'na.** (To André Massena, Prince D'Essling and Marshal of France. Fig. 413.) MASSENA PARTRIDGE. ♂, adult: Upper parts intimately waved with black and reddish-brown and tawny-brown, and marked with sharp buff or whitish shaft-lines; on the wings the irregular black variegation changing to black bars and round spots, in regular paired series on each feather. Outer quills fuscous, their outer webs spotted with white or buff. Under parts crowded with innumerable round white spots on a dark ground, several pairs on each feather: the middle line of the breast and belly mahogany-colored, the flanks, vent, and crissum velvety-black. Top of head black in front, with slight white touches, changing on the crest to brown. Sides of head and throat fantastically striped with black and white; a broad black throat-patch; another on the cheeks, across lores and alongside of crown; a third on the ear-coverts; a fourth bordering the white all around behind. Length about 9.00; extent 17.00; wing 4.75; tail 2.00; tarsus 1.20; middle toe and claw 1.60; its claw alone 0.50

FIG. 413. — Massena Quail, ♂, nat. size.

♀, adult: Upper parts as in the ♂, but the markings of the wings less regular, more assimilated with the general variegation, and the tone more fulvous. No peculiar marks on head throat whitish or buff; general tone of the under parts pale purplish-cinnamon, with fine mottling of black and white on each feather. Young ♂: Resembling the hen, but the under parts ochrey or whitish with black variegation. Chicks, scarcely fledged, 3–4 inches long. Bill reddish above, whitish below; feet dull brownish. Above, light warm brown, varied with black, boldly striped with white — each feather having a hammer-headed white shaft-line. Some inner wing-quills like the back; others dusky with whitish shafts, broken-barred with buff, chiefly on outer webs. Below, buffy-white, with numberless spots of blackish paired on each feather, sharp and circular on breast, further back widening to bars. A singular species, very showy in full plumage, inhabiting portions of Texas, N. M., and Ariz.; in the latter, W. to Fort Whipple at least.

[Subfamily PERDICINÆ: Old World Partridges and Quail.

It becomes necessary to introduce this group, in consequence of the naturalization of the imported Migratory or Messina Quail of Europe. I know of no characters to distinguish it from *Odontophorinæ*, and doubt that there are any.]

215. **COTUR'NIX.** (Lat. *coturnix*, a quail; from its note.) Bill smaller and much slenderer than that of any of the foregoing genera of *Odontophorinæ;* nasal fossæ feathered, except on the tumid nasal scale. Wings of moderate length, little vaulted and not rounded, pointed by the

1st–3d quills, the 1st not shorter than the next. First primary emarginate on inner web; 2d and 3d sinuate on outer web. Tail extremely short and slight, not half as long as the wing, pointed, its feathers very soft, the central pair lanceolate. Feet small; tarsus shorter than middle toe and claw, slightly feathered above in front, with two rows of alternating large scutella in front, two rows of smaller rounded scales meeting in a ridge behind, the sides filled in with small plates. Size smaller than that of any of the foregoing species; pattern of coloration somewhat as in *Ortyx;* sexes nearly alike.

579. C. dactyli'sonans. (Gr. δάκτυλος, *daktulos*, the finger; a metrical measure consisting of a long and two short syllables; Lat. *sonans*, sounding. Fig. 414.) MESSINA QUAIL. MIGRA-

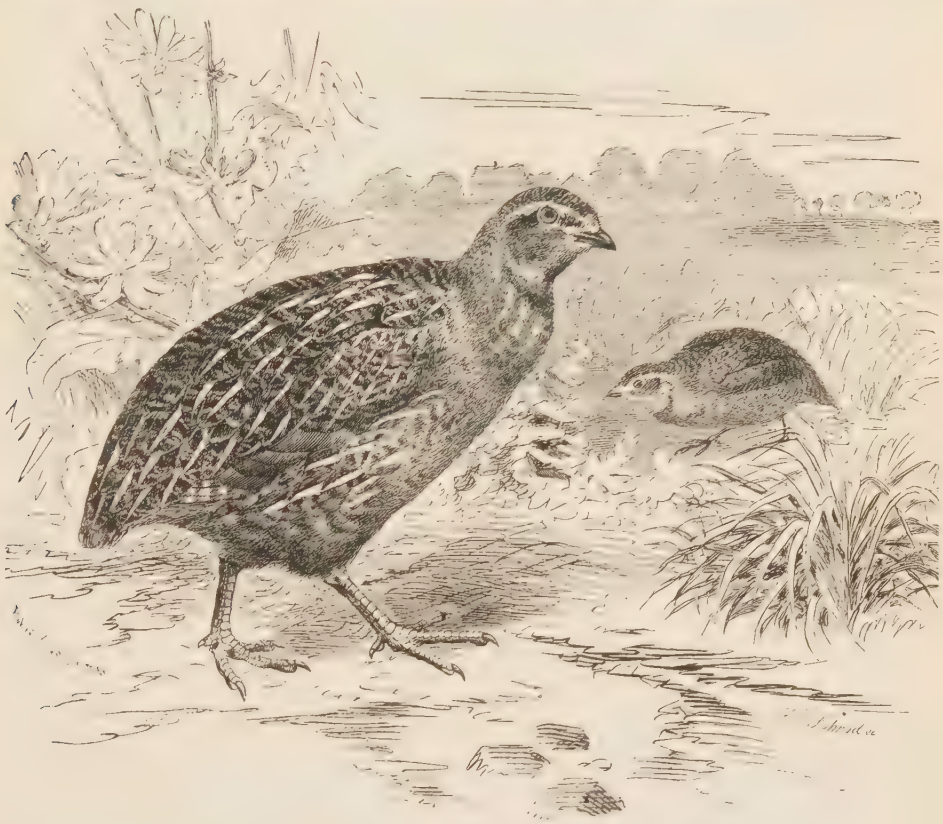


FIG. 414. — Common Quail of Europe, ½ nat. size. (From Brehm.)

TORY QUAIL. COMMON QUAIL of Europe. Adult ♂ ♀: Upper parts variegated with buff or whitish and black upon a mixed reddish-brown and gray ground, the most conspicuous markings being sharp lance-linear lengthwise stripes of buff or whitish over most of the upper parts, these dashes mostly edged with black; other less prominent buff or whitish cross-bars, several to a feather, likewise framed in black. Crown mixed brown and black, with sharp median and lateral buff stripes. Throat white, bounded before by a dark bar curving down behind the auriculars; behind, by a necklace of ruddy-brown, blackish, or whitish spots; chin varied with dark marks in advance of the auricular bar. Under parts fading to whitish from the buff or pale yellowish-brown breast, without any dark crossbars, but the long feathers of the sides and flanks with large and conspicuous white shaft-stripes and otherwise variegated with black,

brown, and buff. Primaries fuscous, spotted with light brown on outer webs; secondaries similar, but the markings becoming bars on both webs. Tail-feathers brownish-black, much varied with shaft-lines, cross-bars, and edgings of buff; crissum immaculate, like the abdomen. Bill dark; feet pale: iris dark brown. Length about 7.00; wing 3.75; tail 1.75; tarsus 1.00; middle toe and claw rather more. Europe, Asia, etc., recently imported and turned loose in considerable numbers in the U. S., as in New England; but its permanent naturalization is still open to question. If one will compare this bird with the bob-white he will see how very different is the Old World quail from our *Ortyx*, or any other birds of this country called "quail:" but that it resembles *Ortyx* more nearly than the European partridge, *Perdix cinerea*, does: so that, if we must borrow a name from any Old World birds for our species of *Ortyx*, *Lophortyx*, *Callipepla*, etc., the term 'quail' is rather more appropriate than 'partridge.'

VII. Order LIMICOLÆ: Shore-birds.

Commonly known as the great "plover-snipe group," from the circumstance that the pluvialine and scolopacine birds form the bulk of the order, which is practically equivalent to the *Charadriomorphæ* of Huxley. The species average of small size, with rounded or depressed (never extremely compressed) body, and live in open places on the ground, usually by the water's edge. With rare exceptions, the head is completely feathered; the general pterylosis is of a nearly uniform pattern. The osteological characters are shared to some extent by certain swimming birds, as Gulls and Auks; the palate is schizognathous; the nasal bones are normally schizorhinal; the angle of the mandible is produced into a slender hooked process; the maxillo-palatines are thin and scroll-like; there are prominent basipterygoid processes; the rostral bones are slender, often much elongated; the sternum is usually doubly, sometimes singly, notched behind; the carotids are double; the syringeal muscles not more than one pair. The physiological nature is præcocial and ptilopædic; the eggs, averaging four, as a rule are laid on the ground in a rude nest or bare depression; the young hatch clothed and able to run about. The food is insects, worms, and other small or soft animals, either picked up from the surface, or probed for in soft sand or mud, or forced to rise by stamping with the feet on the ground: from this latter circumstance, the birds have been named *Calcatores* (stampers). With a few exceptions, the wing is long, thin, flat and pointed, with narrow stiff primaries, rapidly graduated from 1st to 10th; secondaries in turn rapidly lengthening from without inward, the posterior border of the wing thus showing two salient points separated by a deep emargination. The tail, never long, is commonly quite short, and has from 12 (the usual number) up to 20 or even 26 feathers (in one remarkable group of Snipe). The legs are commonly lengthened, sometimes extremely so; rarely quite short, and are usually slender; they are indifferently scutellate or reticulate, or both. The feathers rarely reach the suffrago. The toes are short (as compared with the case of Herons and Rails), the anterior usually semipalmate, frequently cleft to the base, only palmate in *Recurvirostra* and only lobate in *Phalaropodidæ*. The hinder is always short and elevated, or absent. The length of the phalanges of the anterior toes decreases from the basal to the penultimate. The lower part of the crus never has feathers inserted upon it, though the leg may *appear* feathered to the suffrago, owing to the length of the feathers. The bill varies much in length and contour, but is almost always slender, contracted from the frontal region of the skull, and is as long as, or much longer than, the head, representing the "pressirostral" (pluvialine) and "longirostral" (scolopacine) types. Furthermore, it is generally in large part, if not entirely, covered with softish skin, often membranous and sensitive to the very tip, and only rarely hard throughout. The nostril is generally a slit in the membranous part, and probably never feathered.

Most of the families of this order are well represented in this country, and will be found fully characterized beyond. The position of *Parridæ* is in question, and it probably belongs here rather than among the families where it is ranged (beyond). There are several outlying or

inosculating families in the vicinity of *Limicolæ* and *Alectorides*, of uncertain position. The largest of these is the Bustard family, *Otididæ*, which connects *Limicolæ* and *Alectorides* so perfectly, that its position has long wavered between these two orders; the balance of evidence favors its reference to the latter. The typical families are *Charadriidæ* and *Scolopacidæ*.

38. Family CHARADRIIDÆ: Plover.

FIG. 415. — A Plover, the European Lapwing, reduced. (From Dixon.)

This is a large and important family of nearly a hundred species, of all parts of the world. Its limits are not settled, there being a few forms sometimes referred here, sometimes made the types of distinct families. The Glareoles (*Glareolidæ*) are a remarkable Old World form, like long-legged swallows, with a cuckoo's bill; the tail is forked; there are four toes; the wings are extremely long and pointed; the tarsi are scutellate; the middle claw denticulate. The Coursers (*Cursoriinæ*) are another Old World type, near the Bustards, of one or two genera and less than ten species. In both of these the gape of the mouth is longer than in the true plovers; the hind toe, as usual for this family, is absent in the Coursers. The thick-knees, (*Œdicneminæ*) are more plover-like birds, with one exception belonging to the Old World, comprising about eight species of the genera *Œdicnemus* and *Esacus*; they are related to the Bustards, and most pluvialine birds appear to fall in the

54. Subfamily CHARADRIINÆ: True Plover.

Toes generally three, the hinder absent (excepting, among our forms, *Squatarola*, *Vanellus*, and *Aphriza*); tarsus reticulate, longer than the middle toe; toes with a basal web (cleft in *Aphriza*); tibiæ naked below. Bill of moderate length, much shorter or not longer than the head, shaped somewhat like that of a Pigeon, with a convex horny terminal portion, contracted behind this; the nasal fossæ rather short and wide, filled with soft skin in which the nostrils open as a slit, not basal, and perforate. Gape very short, reaching a little beyond base of culmen. Wings long and pointed, reaching, when folded, to or beyond the end of the tail, and sometimes spurred; crissal feathers long and full; tail short, generally nearly even and of 12 feathers; body plump; neck short and thick; head large, globose, sloping rapidly to the small base of the bill, usually fully feathered. Size moderate or small.

Our species (excepting *Aphriza*, if really belonging here) are very closely related, and will be readily recognized by the foregoing characters. There are in all perhaps sixty species. The most singular of them is the *Anarhynchus frontalis*, in which the bill is bent sideways. *Thinornis zelandiæ* of New Zealand, *Phegornis mitchelli* and *Oreophilus totanirostris* of Chili, are peculiar forms. Species of *Chettusia*, *Lobivanellus* and *Hoplopterus* have fleshy wattles, or a tubercle, often developed into a spine, on the wing, or both; some of these, and others,

are crested. These are all near *Vanellus* proper, and a part of them are 4-toed. Our species are found along the seashore, by the water's edge in other open places, and in dry plains and fields. They all perform extensive migrations, appearing with great regularity in the spring and fall, and most of them breed far northward. They are all more or less gregarious, except when breeding. They run and fly with great rapidity; the voice is a mellow whistle; the food is chiefly of an animal nature. The eggs are commonly four in number, speckled, very large at one end and pointed at the other, placed with the small ends together in a slight nest or mere depression in the ground. The sexes are generally similar, but the changes with age and season are great.

Analysis of Genera.

Toes 4.
- Head not crested.
  - Tarsi scutellate in front; toes cleft to base . . . . . *Aphriza* 221
  - Tarsi reticulate; toes with basal web . . . . . *Squatarola* 216
- Head with a long flowing crest . . . . . *Vanellus* 220

Toes 3.
- Plumage of upper parts speckled; no rings or bands of color about head or neck . . . *Charadrius* 217
- Plumage of upper parts not speckled; rings or bands of color about head and neck.
  - Tarsus not nearly twice as long as middle toe without claw . . . . . *Ægialites* 218
  - Tarsus about twice as long as middle toe without claw . . . . . *Podasocys* 219

216. SQUATARO'LA. (Ital. *squatarola*, name of the species. Fig. 416.) FOUR-TOED PLOVER. A small but distinct hind toe, contrary to the rule in this family. Tail less than half as long as wing. Tarsus much longer than middle toe and claw. Tibia bare below, reticulate like the tarsus. Basal web between outer and middle toes. Upper plumage speckled, lower black or white; no rings or bars of color about head or neck. Legs dark-colored. Tail fully barred. Seasonal changes of plumage very great; sexes alike.

FIG. 416. — Bill and hind toe of *Squatarola*, nat. size. (Ad nat. del. E. C.)

880. S. helve'tica. (Lat. *Helvetica*, Helvetian, Swiss. Fig. 417.) SWISS PLOVER. BLACK-BELLIED PLOVER. BULL-HEAD PLOVER. WHISTLING FIELD PLOVER. OX-EYE. ♂ ♀, in summer: Upper parts fretted with blackish and ashy-white, the feathers being white basally, then black, tipped and usually scalloped with white. Upper tail-coverts mostly white, with few dark touches. Fore-head, line over eye and thence more broadly over side of neck, the lining of wings, tibiæ, vent and under tail-coverts, white. Sides of head to an extent embracing the eyes, axillary plumes, and entire under parts (except as said), black. Tail closely barred with black and white. Primaries dark brown, blackening at tips, with large basal areas and a portion of their shafts, white. Bill and feet black. Length 11.00–12.00; wing 7.00–7.50; tail 3.00; bill 1.00–1.25; tarsus 2.00; middle toe and claw 1.33; tibiæ bare 1.00. But such a bird as this rarely seen in the U. S. ♂ ♀, old, in fall and winter, as usually seen in U. S. Under parts white or whitish, anteriorly speckled or mottled with grayish-brown; axillary plumes, however, black, as before; a good color-mark of the species, in any plumage, in comparison with the golden plover. Birds changing show every mixture of black and white below. ♂ ♀, young: Similar to winter adults, but upper parts speckled with golden-yellow, as in *C. dominicus*, most of the feathers having edgings of this color. Feet grayish-blue. A large stout plover, with a little hind toe, commonly diffused over most parts of the world: in America, breeding in Arctic regions, flocking south and north in fall and spring, preferably coastwise; common, but less so than *C. dominicus*. Eggs 4, pyriform, 1.90 to 2.30 long by 1.40 to 1.45 broad; drab or dark brownish clay-color, very heavily marked, especially on the larger half of

the shell, with irregular blotches of brownish-black, smaller spots being more thinly distributed over the rest of the surface; the markings about the great end usually confluent and wreathy; a few pale markings in the shell.

FIG. 417. — Black-bellied Plover, in summer, reduced. (From Lewis.)

217. CHARA'DRIUS. (Gr. χαραδριός, *charadrios*, Lat. *charadrius*, a plover.) GOLDEN PLOVERS. Characters as in *Squatarola*, but no hind toe. (This is the type-genus of the whole family. The several species are closely related: to our long known golden plover have lately been added as birds of N. A. both the European species and the Asiatic variety; the former from its occurrence in Greenland, the latter in Alaska. U. S. birds are all *C. dominicus*, — the *C. virginicus* of most authors.)

Analysis of Species.

Lining of wings ashy.
- Length 10.00–11.00; wing 7.00; tail 3.00; tarsus 1.75 . . . . . *dominicus* 581
- Length 9.00–10.00; wing 6.50; tail 2.50; tarsus 1.60 . . . . . *fulvus* 582

Lining of wings white . . . . . *pluvialis* 583

581. C. domi'nicus. (Lat. *dominicus*, of St. Domingo. Fig. 418.) AMERICAN GOLDEN PLOVER. FIELD PLOVER. BULL-HEAD PLOVER. BULL-HEAD. ♂ ♀, in summer: Upper parts black, everywhere speckled with golden-yellow, and mostly also with white, the brighter color in excess. The markings of individual feathers are a tipping and one or several paired scallops. Hind neck less strongly marked than crown or back. Forehead, and long stripe over eye snowy-white. Region immediately around bill, sides of head to include eyes, and entire under parts, glossy brownish-black. *Lining of wings, and axillars, sooty-gray or ashy.* Tail dusky grayish-brown, with numerous irregular pale gray bars, and reddish-brown shafts; upper tail-coverts and rump like back. Primaries fuscous, blackening at tips and whitening at bases of inner webs, though without definite white spaces; shafts white for a space. Secondaries and many of the coverts, like the primaries, plain fuscous, without the golden and white fretwork of the back. Bill and feet black. Length 10.00–11.00; extent 22.50; wing 7.00; tail 3.00; bill 0.90; tibiæ bare 1.00; tarsus 1.75; middle toe and claw 1.20. ♂ ♀, in winter, and young, much alike, very different from the breeding dress: Upper parts much as before, but colors not so pure and intense; and spotting mostly golden, with little white if any. Front and line over eye not purely white, but tawny, with dusky streaks. Tail lacking transverse bars, the feathers being dark grayish-

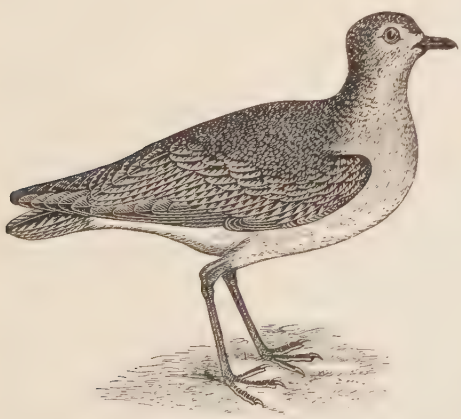


FIG. 418. — Golden Plover, in fall or winter, reduced. (From Nuttall, after ——?)

brown with white or yellow edging and notching. Axillars and lining of wings ashy-gray as in summer; but, as in *Squatarola*, the chief difference is in the under parts, which have no black, being grayish-white, clearest on chin, belly, and crissum, the throat and sides of head streaked, the breast and sides of neck and body mottled, with dark grayish-brown. Legs not perfectly black. This is the state in which the golden plover is generally seen in the U. S., though beautiful black-bellied birds may be found late in the vernal migration. N. Am. at large; breeds in the Arctic regions; passes N. and S. in great waves, in spring and fall, affording fine sport at the latter season. Eggs 4, similar to those of *Squatarola*, smaller, and usually paler clay color, sometimes whitish; markings of same tone and pattern; size 1.80–2.00 × 1.35–1.40. This is the usual "field plover" of sportsmen; a well-known and highly-esteemed game-bird.

582. **C. d. ful'vus.** (Lat. *fulvus*, yellowish.) ASIATIC GOLDEN PLOVER. Similar; more suffused with yellow on head, especially along the superciliary stripe; smaller; length about 9.50; wing 6.50; tail 2.60; tarsus 1.60; middle toe and claw 1.10; bill 0.95. Alaska, from Asia.

583. **C. pluvia'lis.** (Lat. *pluvialis*, rainy.) EUROPEAN GOLDEN PLOVER. Like *C. dominicus*, and of same size. Lining of wings *white*. Greenland, from Europe.

218. **ÆGIA'LITES.** (Gr. *αἰγιαλίτης*, a doer by the sea.) RING PLOVERS. A genus not easy to define with precision, owing to the differences in details of form which the numerous species present. Best distinguished from *Charadrius* by color: upper parts not speckled; lower never extensively black. Bars or rings of color about head and neck. Sexes usually distinguishable, though similar. Tarsus not twice as long as middle toe without claw. Plates of front of tarsus tending to enlarge in two or three special rows, instead of uniform reticulation. We have 5 perfectly good N. American species, a variety of one of these (?), and two European estrays.

Analysis of Species (adult males).

Bill entirely black.
- Rump chestnut; two black bands on throat and breast . . . . . *vociferus* 584
- Rump plain; one black band on breast. Bill stout . . . . . *wilsonius* 585
- Rump plain; no complete black bars on breast. Bill slender . . . . . *nivosus* 591

Bill orange or yellow, black-tipped; or black with orange at base.
- Semipalmate; web between inner and middle toe evident, that between outer and middle reaching to end of second joint of middle.
  - Heavy black bands on head and neck; colored ring round eye . . . . . *semipalmatus* 586
- No evident web between inner and middle toe; that between outer and middle only reaching to end of first joint of middle.
  - Heavy black bands on head and neck; one on side of head.
    - No colored ring round eye. Wing about 5.00 . . . . . *hiaticula* 589
    - A colored ring round eye; wing under 4.50 . . . . . *curonicus* 590
  - No black band on side of head; colored ring round eye.
    - Ring around neck incomplete . . . . . *melodus* 587
    - Ring around neck complete . . . . . *circumcinctus* 588

584 **Æ. voci'ferus.** (Lat. *vociferus*, voice-bearing, noisy. Fig. 419.) KILDEER PLOVER. ♂ ♀, adult: Above, grayish-brown, with an olive shade, and in high plumage a slight bronzy lustre. Rump and upper tail-coverts bright-colored, very variable in tint, from tawny or orange-brown to cinnamon-brown or chestnut. Forehead with a white band from eye to eye, more or less prolonged as a superciliary streak, and a black band above it. A white collar around hind neck, continuous with white of the throat. A black collar around back of neck, continuous with a black pectoral band. Back of the latter a black pectoral belt. Thus the fore-parts are encircled with one complete black ring, behind which is a black half-ring on breast, before which is a complete white ring. A white stripe over and behind eye; a dusky stripe below eye. Under parts entirely pure white, except the two pectoral belts. Primary quills blackish; a white space on the outer webs of most of them, forming an oblique series, and a longer white space on their inner webs. Secondaries mostly white, but with black areas in increasing size from within outward. Long inner secondaries, or tertiaries, like the back. Tail-feathers singu-

larly variegated; several inner pairs like the back, insensibly blackening towards ends, then lightening again, and usually with rusty tips; lateral ones gaining more and more of the bright color of the rump, with more definite black subterminal bars, and pure white tips; outermost pair mostly white, with the rufous shade, and several broken black bars. The effect of all this variegation is very striking when the parts are displayed in flight. Bill black; eye black, with a bright ring around it; legs pale. Length 9.00–10.00; extent 20.00; wing 6.00; tail 3.50–4.00, proportionally longer and more rounded than usual in this genus; bill 0.80; tibiæ bare 0.80; tarsus 1.40; middle toe and claw 1.12. ♂ ♀, young: The black bands replaced by gray; upper parts duller and more grayish; and when quite young the feathers of the upper parts spotted with rusty brown; rump pale, markings of tail incomplete; but the birds speedily acquire a plumage like that of the adults. Downy young: Above, gray with a ruddy tinge; a ring round top of head, a ring round neck, a stripe down back, and another on each side of the colored area, black; collar round back of neck, forehead, and ends of wing-tufts, white; tail-tuft and bill black — queer little creatures, readily recognized. N. Am. at large, very abundant, breeding anywhere; abounds in the West. Not gregarious nor maritime; extensively but somewhat irregularly migratory. A very noisy bird — the curious name is derived from its shrill two-syllabled whistle, like *kil-deer! kil-deer!* Nest anywhere in the grass or shingle near water. Eggs 4, about 1.50 × 1.12, of usual wading-bird shape; ground varying from drab through clay-color to creamy, marked in endless variation with blackish-brown. Kildeers' eggs and those of *Tringoides macularius* do excellent duty in boys' and amateurs' cabinets for those of most small waders.

FIG. 419. — Kildeer Plover, nat. size. (Ad. nat. del. E. C.)

585. Æ. wilso'nius. (To Alexander Wilson.) WILSON'S PLOVER. Adult ♂ ♀: Above, pale ashy-gray (dry-sand color), the feathers with still paler edges, the shade tending to fulvous on the nape and hind neck. A narrow black band across vertex, not reaching to eyes, being cut off by white of the forehead which extends backward over each eye to nape. A blackish loral stripe, not prolonged behind eye, *not* meeting its fellow over base of bill, where the white forehead comes down to the bill. A black half-ring on the foreneck, *not* completed around back of neck. White of throat passing around hind-neck as a slight collar. Under parts, excepting the black bar, entirely white. Primaries blackish, bleaching towards bases on inner webs, the short inner ones also with white on outer webs. Shaft of 1st primary almost entirely white; of others brown, then a long white space, then blackening at end. Secondaries, excepting the long inner ones, mostly white on inner webs, dark on outer. Middle and intermediate tail-feathers like back, growing dusky toward ends, nearly all with white tips, and the outer one or two white. No colored ring round eye. Bill entirely black; extremely large and stout. Legs flesh-colored; outer toe semipalmate, inner cleft. Length 7.00–8.00; wing 4.50–5.00; tail 2.00, nearly square; tarsus about 1.10; middle toe and claw 0.90; bill 0.90, not much shorter than head. Young: Similar; no black on vertex or lore; a broad band of the color of the back across the neck in front. Seacoast of S. Atlantic and Gulf States, common; N. to the middle districts, and rarely to New England; also on the Pacific side to California? S. in winter into S. Am. Eggs laid on the bare shingle of the beach; usually 3, 1.22 to 1.45 long, 1.00 to 1.05 broad, pale olive-drab, more greenish in some cases, more clay-colored in others,

thickly marked all over with blackish-brown in irregular sharply-defined spots, splashes and fine dots. Note low, piping, and rather plaintive.

586. Æ. semipalma'tus. (Lat. *semi*, half; *palmatus*, palmated: the species is remarkably distinguished by the extent of the half-webbing between the toes.) SEMIPALMATED PLOVER. RING PLOVER. RING-NECK. ♂ ♀, adult: Upper parts uniform dark ashy-gray (wet-sand color); under parts pure white. A broad black ring encircling the neck. In advance of this a white half-collar around back of neck, spreading into the white of the throat. A white frontal bar, entirely surrounded by black: *i. e.* a black coronal bar and black stripe along lore and side of head, meeting its fellow over base of upper mandible. Primaries blackish, with narrow white spaces reduced to a portion of the shaft alone on the outer primary; secondaries largely white, and greater coverts white-tipped; tertiaries like the back. Tail like back, the feathers insensibly blackening toward their ends, most of them white-tipped, the outermost nearly all white. An orange ring round eye, very bright. Bill black, with orange base; legs yellowish. Web between outer and middle toe reaching to end of the second joint of the latter. Length about 7.00; extent 15.00–15.50; wing 4.75–5.00; tail 2.25, rounded; bill 0.50; tarsus 0.90; middle toe and claw the same. Young: No black coronal bar, the white of forehead reaching bill and eyes, and prolonged over the latter; neck-ring and loral stripe gray, not black; bill mostly black. Upper parts with slight whitish or rusty edging of the feathers. Chick: Upper parts mottled with gray, black, and brown, in no special pattern. Collar round neck and under parts white. N. Am. at large, the most abundant and generally diffused of the ring-necks, especially plentiful in flocks on the beaches late in the summer and early autumn. Breeds northward; eggs 2 to 4, like the killdeer's; only, of course, distinguishable by much smaller size: length 1.20 to 1.40, by 0.90 to 0.95 in breadth.

587. Æ. melo'dus. (Lat. *melodus*, melodious.) PIPING PLOVER. PALE RING-NECK. ♂, adult. Above, very pale ash, lighter than any other N. A. species. A white half-collar round back of neck. A black ring behind this, tending to encircle the neck; but I have seldom seen it complete on the cervix, and as a matter of fact it is seldom complete on the fore-neck either; ordinarily a link only on each side of the neck. A black coronal bar from one eye to the other. Forehead, sides of head, and entire under parts snowy-white, excepting the black on sides of neck, there being no dark bars on lores or sides of head. Primaries dusky, with large white spaces, their shafts white for a corresponding extent. Secondaries and greater coverts mostly white; long tertiaries like back. Upper tail-coverts and bases of tail-feathers white; the latter blackening towards their ends, the outer pair or two entirely white. A colored ring round eye. Bill yellow, the end beyond the nasal fossæ black — very obtuse and short and stout for its length. Web between outer and middle toe not reaching to end of the basal joint of the latter. Rather smaller than the last; wing 4.50–4.75; tail 2.00–2.25; bill under 0.50; tarsus 0.87; middle toe and claw 0.75. ♀, adult: The coronal bar reduced to a trace, dark brown; the ringing of neck reduced to a dusky-gray spot on each side. Young: Resembling ♀ as just said, but no trace of dark color on head and little if any on sides of neck. A very pretty little species, with its pale dry-sand colored upper parts and stumpy bill; perfectly distinct from the last, with which it is often associated. U. S. and British Provinces, E. of the R. Mts. (beyond which apparently replaced by *A. nivosus*); abundant along the Atlantic coast of the U. S., breeding N. to the St. Lawrence, wintering from the Carolinas southward. Eggs laid preferably on the shingle of the beach, while the semipalmated usually goes to some grassy or mossy spot back of the sand. Eggs pretty certainly distinguishable from those of the other ring-neck by their lighter coloring — there is much the same difference in tone that there is between the birds themselves; clay-color or palest creamy-brown, sparsely and pretty uniformly marked with blackish-brown specks, without spots of any size, or scratchy lines, sometimes mere points; eggs of about same capacity as the ring-neck's, but rather less elongate and pointed; 1.20 to 1.30 × 0.95 to 1.00.

588. Æ. m. circumcinc'tus? (Lat. *circumcinctus*, bound about.) BELTED PIPING PLOVER. A

variety (perhaps only some individuals) with the black necklace complete. Described from the Headwaters of the Platte, in Nebraska, July; probably breeding there.

589. Æ. hiati′cula. (Dimin. of Lat. *hiatus*, a gape; *hiaticula* being a translation of *χαραδριός, charadrios*, because the bird is found about the mouths (*hiatus*) of rivers.) EUROPEAN RING PLOVER. Size of No. 586, or rather larger, and general aspect the same; no evident web between inner and middle toe, that between outer and middle only reaching to end of first joint of the latter; no colored ring round eye; one description would answer for the head-markings of both, but black bars very heavy; white touches on eye-lids. Upper parts hair-brown. Primaries blackish-brown, the outer four or five with white only on the shafts for a space near their ends, the white beginning to invade the webs on the fourth or fifth, and enlarging in width with diminishing length on the rest. Secondaries white with dark ends of diminishing length inwards, till one or two of the short inner ones are almost entirely white; the long flowing innermost ones, however, like the back. Tail as in *Æ. semipalmatus*. Length about 7.50; wing 5.00; tail 2.45; bill 0.60, orange, with black tip; tarsus 0.95; middle toe and claw 0.85; feet orange; claws black. Young like that of *Æ. semipalmatus;* no black on vertex; that of side of head and around neck dusky-gray; whitish front, line over eye, and under eyelid; primaries quite dark with white spaces on shafts and webs well marked; feathers of upper parts with pale beady tips; ends of even middle tail-feathers white. Widely distributed in the Old World; Greenland; Cumberland Sound, N. A. (Description from a N. A. specimen.)

590. Æ. curo′nicus. (Lat. *curonicus*, of Courland, on the Baltic.) EUROPEAN LESSER RING PLOVER. Closely resembling the last; smaller; black bands not so broad; black of vertex and auriculars bordered behind with white; shaft of 1st primary alone white; bill extremely slender, black, yellow only at base of lower mandible; legs yellowish flesh-color; a colored ring round eye. Length about 6.00; bill 0.60; wing 4.35; tail 2.30; tarsus 0.90. Inhabits much of the Old World; questionably N. Am., on the Pacific side. Young: Differs much as young *hiaticula* does. Ring around neck dusky-gray; that on side of head chiefly reduced to a loral stripe. No black across vertex; white of forehead soiled. Upper parts darker than in adult, in an early stage with pale or fulvous edgings of the feathers. (*Æ. microrhynchus* Ridg.)

591. Æ. cantia′nus nivo′sus. (Lat. *cantianus*, Kentish; Lat. *nivosus*, snowy (white).) SNOWY RING PLOVER ♂, in breeding dress: Above, pale ashy-gray, little darker than in *Æ. melodus*. Top of head with a fulvous tinge. A broad black coronal bar from eye to eye. A narrower black post-ocular stripe, tending to meet its fellow on nape, and thus encircle the fulvous area. A broad black patch on each side of the breast; no sign of its completion above or below; no complete black loral stripe (as in *Æ. cantianus*), but indication of such in a small dark patch on either side of base of upper mandible. Forehead, continuous with line over eye, sides of head excepting the black post-ocular stripe, and whole under parts excepting the black lateral breast-patches, snowy-white. No white ring complete around back of neck. Primaries blackish, especially at bases and ends, the intermediate extent fuscous; shaft of the 1st white, of others white for a space; nearly all the primaries bleaching toward bases of inner webs, but only some of the inner ones with a white area on outer webs. Primary coverts like the primaries, but white-tipped. Greater coverts like the back, but white-tipped. Secondaries dark brown, bleaching internally and basally in increasing extent from without inwards, their shafts white along their respective white portions. Tertiaries like back. Several intermediate tail-feathers like back, darkening toward ends; two or three lateral pairs entirely white; all the feathers more pointed than usual. Bill slender and acute, black. Legs black. Length 6.50–7.00; extent 13.50–14.00; wing 4.00–4.25; tail 2.00 or less; bill 0.60; tarsus 1.00; middle toe and claw 0.75. In winter (young?): Upper plumage rather darker than as above said, and less uniform, the individual feathers with pale edges. Whole crown like back; no black or fulvous on head; forehead white; lores slightly dusky; black of sides of breast replaced by a patch of the color of the back. Bill black; tarsi livid

bluish; toes blackish. U. S., chiefly west of the R. Mts.; Utah; Cala. coast, breeding and wintering; also, coast of Texas. A specimen (♂, Corpus Christi, Texas, *June* 24, *Sennett*) though in midsummer plumage, has no fulvous on head; no trace of loral mark; the coronal bar, post-ocular stripe, and lateral pectoral blotch dark brown, not black. Eggs 3; tone and style of coloration about as in *wilsonius;* size as in *melodus*, but markings more numerous and scratchy; 1.20×0.90. (Probably specifically distinct from *Æ. cantianus.*)

219. **PODASO'CYS.** (The Homeric epithet of Achilles, *πόδας ὠκύς, podas okus*, swift as to his feet.) MOUNTAIN PLOVER. In general, characters of *Ægialites;* but no black belt or patches on neck or breast; a coronal and loral black bar. Size large. Tail short, half the wing, square. Legs very long; tibiæ nude for a distance ⅔ the length of tarsus. Latter more than half as long again as middle toe and claw. Toes very short, the lateral of unequal lengths. Tarsus and tibia entirely reticulate. Sexes alike. One species.

592. **P. monta'nus.** (Lat. *montanus*, of mountains. Badly named: it is a prairie bird.) PRAIRIE PLOVER. "MOUNTAIN" PLOVER. ♂ ♀, in summer: Upper parts uniform grayish-brown; in most breeding individuals the shade is pure, but in many cases the feathers are skirted with tawny or ochrey. Under parts entirely white (*no* black belt or patches); but the breast often shaded across with diffuse fulvous or gray. A sharp black loral line from bill to eye, cutting off the white forehead and superciliary line from the white of other parts. A coronal black bar across the sinciput, varying in width from a mere line to a band nearly half the length of crown in width. Quills blackish, the shaft of the first white, of the others white for a space; some of the inner primaries with white spaces toward the bases of the outer webs, and the secondaries a little pale on their inner webs. Tertiaries and greater coverts like back, the latter white-tipped. Tail-feathers like back, blackening toward ends, the outermost pale throughout; all tipped with whitish. Bill black, slender; legs pale; the toes darker. Length 9.50; extent 18.00; wing 5.50–6.00; tail 2.50–3.00; bill 0.90–1.00; tibiæ bare over 0.50; tarsus 1.67; middle toe and claw 0.90–1.00. The full breeding dress has not before been fairly described. ♂ ♀, in winter: No black coronal or loral stripe; otherwise, generally as in summer; but the general plumage more rusty, with more decided wash of color on the breast. Young: As last said; whole upper parts rusty from extensive edgings of all the feathers; sides of head and neck similarly suffused with tawny. The ground-color of the upper parts is also darker than that of the adults. Chick in down: Forehead, sides of head and under parts white, with sulphury-yellow tinge. Crown, back and tibiæ sulphury or tawny-yellow, closely and evenly mottled with black. Unmarked line over eye; black ear-spot. Bill light at extreme base below, and at the point. Livid patch of naked skin on neck. An interesting, isolated species, plentifully and generally distributed in western U. S., Plains to the Pacific; N. to 49° at least. I have shot it in Kansas, Colorado, Wyoming, New Mexico (June), Arizona, Montana (49°, June), California coast (November), etc. It is not *Eudromias*, and sufficiently unlike *Ægialites*. It inhabits the most sterile prairie as well as better watered regions, quite independently of water, and is not in the least aquatic; even on the Cala. coast it haunts the plain, never the marsh, mud-flat, or beach. Feeds chiefly upon insects, especially grasshoppers, and is generally seen in loose straggling companies of small extent. Nest anywhere on the bare prairie; eggs 3–4; 1.40 to 1.50 long, by 1.10 broad, less pointed than plovers' eggs usually are, olive-drab with a brown shade, profusely dotted all over, but especially at the larger end, with blackish, dark brown and neutral tint; the markings all mere dots and points, the largest scarcely exceeding a pin's head. June, July.

220. **VANEL'LUS.** (Lat. *vanellus* or *vannellus*, diminutive of *vannus*, a fan.) LAPWINGS. Bill slender, shorter than head, perfectly pluvialine. Legs long; tibia much denuded below; tarsus greatly longer than middle toe and claw. A web between bases of middle and outer toes; inner toe cleft to the base. A small hind toe. Wings very long, folding to end of the long square tail, but rounded, 2d 5th primaries subequal and longest, 1st about equal to 7th; primaries

very broad, 3 or 4 outer ones much narrowed toward end. A long thin recurved occipital crest of filamentous feathers. Plumage of upper parts highly lustrous with metallic iridescence.

593. **V. crista'tus.** (Lat. *cristatus*, crested. Fig. 415.) CRESTED LAPWING. Adult ♂: Top and front of head, including the 2–3 inch long crest, throat-line, and large pectoral area, glossy black. Sides of head mostly, and sides of neck, white, on hind neck mixed with gray. Upper and under tail-coverts chestnut or orange-brown. Under parts, except as said, snowy-white. Tail white, with broad black bar at ends of feathers excepting outermost, tips of all narrowly white. Upper parts iridescent green, passing on wings to violet-purple and steel-blue. Quills glossy blue-black, several outer primaries fading to grayish-white on the narrow terminal portion, the secondaries white at base. Bill black; feet red. This splendid wanton of the crest inhabits Europe, etc., and has occurred in Greenland.

55. ? Subfamily APHRIZINÆ: Surf-birds.

The peculiarities of the single species seem to be super-generic, but the position of *Aphriza* is still open to question; as may be judged from the following diagnosis.

221. **APHRI'ZA.** (Gr. *ἀφρός*, *aphros*, sea-foam; *ζάω*, *zao*, I live: badly formed, but euphonious.) SURF-BIRDS. Bill plover-like, shorter than head, stout at base, contracted in continuity, with enlarged horny termination; both mandibles deeply grooved to their horny ends; nostrils subbasal, close to commissure, linear, perforate; feathers reaching equally far forward on side of each mandible, much farther in interramal space. Wings very long and acute, folding to or beyond end of tail. 1st primary longest, all rapidly graduated; flowing inner quills not nearly reaching point of wing. Tail very short, square, less than one half as long as wing, 12-feathered. Feet scolopacine, with well-developed hind toe; short and stout, much as in *Strepsilas;* tibiæ naked below, but the feathers falling to the suffrago; tarsus little longer than middle toe and claw, reticulate, scutellate in front; toes cleft to the base, lateral of equal lengths, reaching base of middle claw; inner edge of middle claw dilated and jagged. General character of plumage, in its pattern of coloration and seasonal changes, as in *Tringeæ*. One species; a remarkable isolated form, perhaps a plover and connecting this family with the next by close relationships with *Strepsilas*, but with hind toe as well developed as usual in Sandpipers, and general appearance rather sandpiper-like than plover-like. *Aphrizinæ* might go under *Hæmatopodidæ* next to *Strepsilas;* or, perhaps better, *Aphriza* and *Strepsilas* might together constitute a family APHRIZIDÆ, next to, but apart from *Hæmatopodidæ*.

594. **A. virga'ta.** (Lat. *virgata*, striped.) SURF-BIRD. In summer: Dark ashy-brown, streaked with whitish on head and neck, varied with rufous and black on the back and wings. Upper tail-coverts and basal half or more of tail pure white; rest of tail black, white-tipped. Under parts white or ashy-white, variously marked with brownish-black; the throat and fore breast narrowly streaked, the streaks changing on the breast to curved bars, and there very profuse, on other under parts sparse and spotty. Bases and shafts of primaries, tips of most of them, greater part of the secondaries, and tips of greater coverts, white; exposed portions of primaries blackish. Bill black, flesh-colored at base below; legs dusky greenish? In winter: Plumage of the head, neck, breast, and upper parts nearly uniform dusky brown, unvaried with white or reddish, but with obsoletely darker shaft-lines; white under parts slightly spotty; quills and tail-feathers as in summer. Length 9.00–10.00; extent 17.00 or more; wing 6.50–7.00; tail 2.75; bill 1.00; tarsus 1.25; middle toe and claw 1.10. Varies greatly in plumage with age and season, but unmistakable in any guise. Extensively dispersed over the coasts and islands of the Pacific; along whole W. coast of N. A. In Alaska, according to Nelson, it occurs N. to Bering's Strait; and about St. Michael's frequents in August the rocky shores of the small outlying islands, and the capes whose rugged shore-lines afford congenial resorts to the surf-birds and the *Heteroscelus incanus*.

39. Family HÆMATOPODIDÆ: Oyster-catchers. Turnstones.

A small family of two genera and six or eight species, with the bill *hard*, and either acute or truncate, the nasal fossæ short, broad, and shallow; the legs short, stout, brightly-colored. The two following genera differ much — in fact, more than *Aphriza* does from *Strepsilas*; it is unnecessary to give a formal analysis. Each should be type of a subfamily at least.

56. Subfamily HÆMATOPODINÆ: Oyster-catchers.

222. **HÆMATOPUS.** (Gr. *αἱματοπούς, haimatopous*, red-footed; *αἷμα, haima*, blood, *πούς, pous*, foot.) Oyster-catchers. No hind toe. Front toes with basal webbing, conspicuous between middle and outer, and broadly fringed with membrane continuous with the webs to the ends.

Fig. 420. — Bill of Oyster-catcher, nat. size. (Ad nat. del. E. C.)

Tarsus longer than middle toe and claw, reticulate, the plates in front enlarged; shorter than bill. Tibiæ briefly bare below. Legs as a whole very stout, coarse and rough, and light-colored. Wings long and pointed; 1st and 2d quills subequal and longest. Tail short, square, scarcely or not half as long as the wing. Bill peculiar — longer than tarsus, twice as long as head, constricted near the base, much compressed, almost like a knife-blade toward end, and truncate, something like a woodpecker's (it is an efficient instrument for prying open the shells of bivalve mollusks), hard, straight or deflected sideways, highly colored (fig. 420.) Nasal groove very short, broad, and shallow; grooving of lower mandible slight; interramal space very short, scarcely a third the length of the long ascending gonys. Nostrils remote from the feathers, linear, close to edge of bill. Size large. Sexes similar. Coloration dark and white, in masses. Several species, inhabiting the sea-coasts of most countries.

Analysis of Species.

Head, neck and upper back glossy-black; belly white . . . . . *ostrilegus* 595
Head and neck glossy-black; back smoky-brown; belly white . . . . . *palliatus* 596
Head and neck glossy-black; back and belly smoky-brown . . . . . *niger* 597

595. **H. ostri'legus.** (Lat. *ostræa*, an oyster; *lego*, I gather. Fig. 421.) European Oyster-catcher (oyster-opener would be a better name, as oysters do not run fast). Similar to the next to be described. Upper parts glossy-black, like the head and neck. Quills black, broadly margined with white on inner webs excepting towards end, and also with isolated white shafts and spaces near end. Back below, interscapulars, rump, and upper tail-coverts entirely white, as well as bases of the tail-feathers. Length about 16.00; bill about 3.00; wing 9.50; tail 4.30; tarsus nearly 2.00. Europe, Asia, Africa: N. Am. as occurring in Greenland.

596. **H. pallia'tus.** (Lat. *palliatus*, wearing the *pallium*, a cloak.) American Oyster-catcher. Brown-backed Oyster-catcher. Adult ♂ ♀: Bill vermilion or coral-red, changing to yellow at end. Feet pale purplish flesh-color, drying dingy yellowish. Eyes and ring around them red or orange. Whole head and neck all around glossy-black, frequently overcast with an ashy or glaucous shade. Back and wing-coverts smoky-brown — the contrast with the head and neck decided. Rump and central field of upper tail-coverts like back (not white); lateral and longest central coverts white. Tail-feathers white at base for nearly the space covered by the coverts, on the lateral feathers rather farther; then like back, blackening at ends. Tertiaries and long inner secondaries like back; next few secondaries pure white; rest gaining dark color in increasing amount; the white of the secondaries forming with the long

white tips of the greater coverts a conspicuous broad oblique white bar. Primaries dusky, blackening toward end, touched with white at bases of the inner webs of longer ones, with white on outer webs of the short inner ones, but no isolated white subterminal spaces. (Thus much less white on wings and tail than in *ostrilegus*, besides the difference in color of the back; though some allowance in either case must be made for normal variation from the minuteness of my description.) Entire under parts pure white, including lining of wings, where, however, a few dusky feathers commonly show along the edge. Length 17.00–21.00; extent 30.00–36.00; wing 10.00 or more; tail 4.00 or more; tarsus 2.00 or more; middle toe and claw under 2.00. Bill 3 or 4 inches long, varying in shape with almost every specimen, with wear and tear under

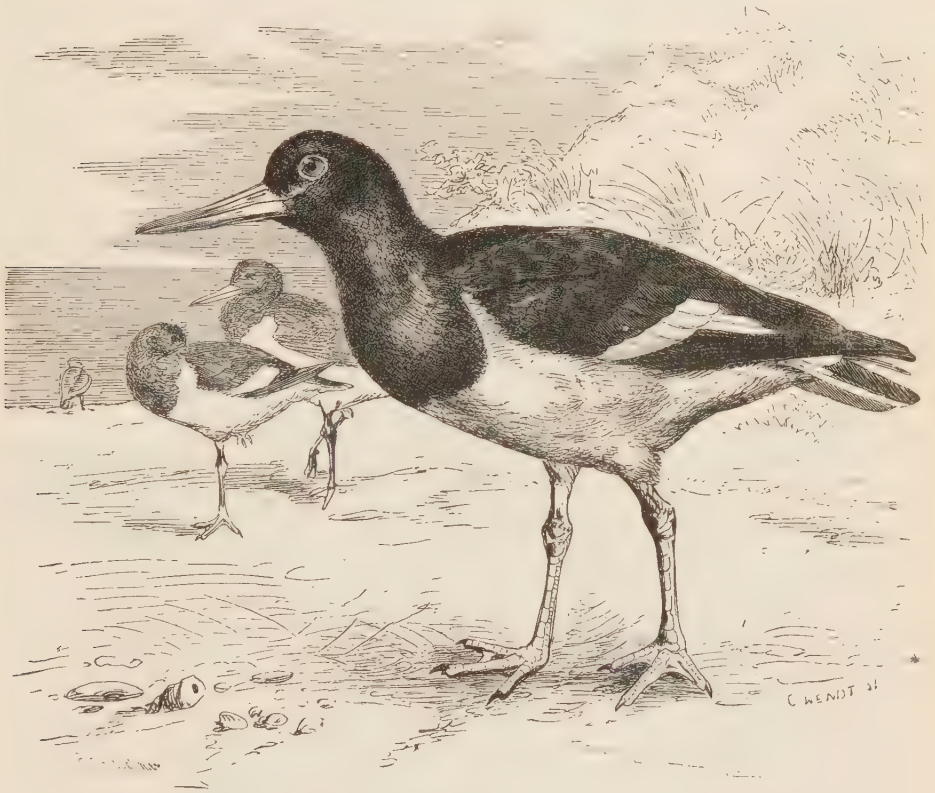


FIG. 421. — European Oyster-catcher, ⅓ nat size. (From Brehm.)

the rough usage to which it is subjected; ordinarily both mandibles truncated; often the lower, sometimes both, acute. Bills worn thinnest and most knife-blade-like towards end are often bent sideways, as if from habitual use of them in a particular direction. N. Am., C. and S. Am., almost entirely coast-wise, and chiefly along the Atlantic, but also on the Pacific side. Migratory all along, wintering from the middle districts southward, breeding in abundance but irregularly at different points. There are extensive breeding resorts along the Virginia coast.

597. H. ni'ger. (Lat. *niger*, black.) BLACK OYSTER-CATCHER. Size and shape of the foregoing. Head and neck the same, but no white on eye-lids, and no white anywhere; rest of plumage dark smoky-brown, blackening on wings-quills and tail-feathers. Pacific coast.

57. Subfamily STREPSILAINÆ: Turnstones.

The character of the subfamily should be constructed to include *Aphriza*, unless *Strepsilas* and *Aphriza* may constitute two subfamilies of a family *Aphrizidæ*. (See p. 605, under *Aphrizinæ*.)

FIG. 422. — Bill of Turnstone, nat. size. (Ad nat. del. E. C.)

223. **STREP'SILAS**. (Gr. στρέψις, *strepsis*, a turning over, λᾶς, *las*, a stone. Fig. 422.) TURNSTONES. Bill shorter than head, not longer than tarsus, constricted at base, then tapering to an acute tip, almost a little recurved. Culmen straight or a little concave, especially over nostrils; commissure straight or slightly recurved; under outline curving up from the base, or straight to angle, then gonys ascending. Nasal fossæ short and broad, about half the length of the bill;

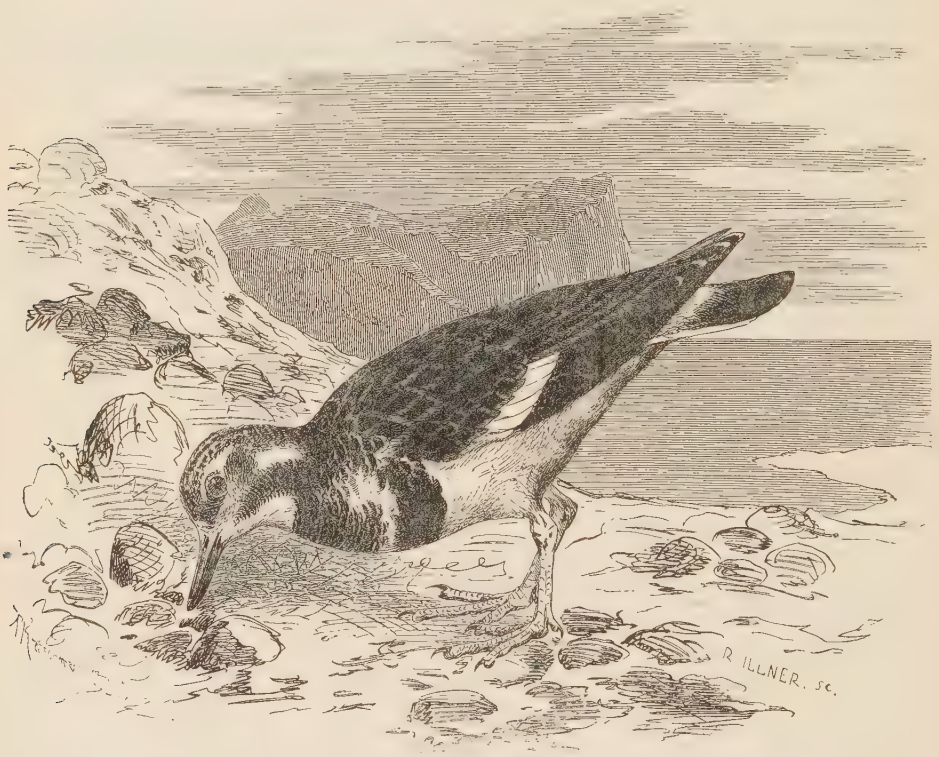


FIG. 423. — Turnstone, ½ nat. size. (From Brehm.)

grooving of under mandible short and shallow. Gonys longer than mandibular rami. Wings long and pointed. Tail short, a little rounded, scarcely or not half as long as wing. Legs short and stout; tibiæ little denuded; tarsus scutellate in front, reticulate on sides and behind, about as long as middle toe and claw. Toes 4, the hinder short, but as well developed as in sandpipers generally, the front toes cleft to the base. Claws curved, compressed, acute. There is probably but one cosmopolitan species, the scientific and vernacular names of which are both derived from its habit of turning over pebbles along the shore in search of food.

Analysis of Species.

Pied with black, white, and chestnut ; feet orange . . . . . *interpres* 598
Blackish and white ; feet dark ? . . . . . *melanocephalus* 599

598. S. inter'pres. (Lat. *interpres*, a factor, agent, go-between. Fig. 423.) TURNSTONE. BRANT BIRD. CALICO-BACK. Adult ♂, in breeding dress: Pied above with black, white, brown, and chestnut-red; below, snowy, with jet breast. Top of head streaked with black and white. Forehead, cheeks, sides of head and back of neck, white, with a bar of black coming up from the side of neck to below eye, then coming forward and meeting or tending to meet its fellow over base of bill, enclosing or nearly enclosing a white loral, and another black prolongation on side of neck; lower eye-lid white or not. Lower hind neck, interscapulars and scapulars, pied with black and chestnut; back, rump, and upper tail-coverts, snowy-white, with a large central blackish field on the latter. Tail white, with broad subterminal blackish field, narrowing on outer feathers and incomplete, widening to usually cut off white tips of central feathers. Wing-coverts and long inner secondaries pied like the scapulars with black and chestnut, the greater coverts broadly white-tipped or mostly white, the short inner secondaries entirely white, the rest acquiring dusky on their ends to increasing extent, with result of a broad oblique white wing-bar. Primaries blackish, the longer ones with large white fields on inner webs, the shorter ones also definitely white on outer webs for a space, the shafts white unless at end; primary coverts white-tipped. Under parts, including under wing-coverts, snowy-white, the breast and jugulum jet-black, enclosing a white throat-patch, and sending limbs on sides of head and neck as above said. Bill black; iris black; feet orange. ♀ similar, lacking much of the chestnut, replaced by plain brown, especially on the wing-coverts; the dark parts in same pattern, but restricted somewhat, the black not jet and glossy. Adults in winter, and young, lacking the chestnut entirely, the black mostly replaced by browns and grays, that of the breast especially restricted or very imperfect. Length 8.00–9.00; extent 16.00–19.00; wing 5.50–6.00; tail 2.50; bill 0.80–0.90; tarsus, or middle toe and claw, about 1.00. Nearly cosmopolitan; in N. Am., both coasts abundantly, and infrequently on the larger inland waters; migrating through and wintering in the U. S., breeding in high latitudes.

599. S. melanoce'phalus. (Gr. μέλας, *melas*, black; κεφαλή, *kephale*, head.) BLACK-HEADED TURNSTONE. Without any of the chestnut coloration of the last, the parts that are pied in *interpres* being blackish; the white parts, however, and the distribution of the colored areas, nearly the same. In the most perfect cases I have seen, the entire head, neck, and breast are dark smoky-brown, the color extending further along the breast than the jet plastron of *interpres*, and not uniform, but the dark brown nebulated with sooty centres of the feathers, and shaded by mixture of white-tipped feathers into the white of the under parts. White lower back, rump, and upper tail-coverts, with black central field of the latter, as in *interpres;* black and white of wings substantially the same, but most of the primaries narrowly white-tipped. Feet apparently of some obscure dark color. Other specimens have a distinct white loral spot, and indication of the white of head and neck of *interpres* in white speckling. No trace of chestnut seen in any. Size and form precisely as in *interpres*. Apparently a permanent melanism; if so, a very curious case, and a good species. Pacific coast.

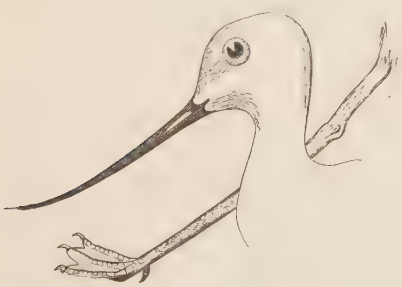


FIG. 424. — Head and foot of Avocet, about ½ nat. size.

40. Family RECURVIROSTRIDÆ: Avocets. Stilts.

Another small family, characterized by the extreme length of the slender legs, and the extreme slenderness of the long acute bill, which is either straight or curved upward. *Recurvirostra* is 4-toed,

and full-webbed; the bill is decidedly recurved, flattened, and tapers to a needle-like point; the body is depressed; the plumage underneath is thickened as in water-birds. The species swim well. *Himantopus* is 3-toed, semipalmate, the bill nearly straight, and not flattened; in relative length of leg it is probably not surpassed by any bird whatsoever. These two genera, each of three or four species of various parts of the world, with the *Cladorhynchus pectoralis* of Australia, compose the family.

224. **RECURVIROSTRA**. (Lat. *recurvus*, bent upward; *rostrum*, bill. Fig. 425.) AVOCETS.

FIG. 425. — European Avocet, *Recurvirostra avocetta*, ¼ nat. size. (From Brehm.)

Bill excessively slender, more or less recurved, then the upper mandible hooked at the extreme tip; much longer than head, more or less nearly equalling tail and tarsus; flattened on top, without culminal ridge. Wings short (for a wader). Tail very short, square, less than half the wing. Legs exceedingly long and slender; tibiæ long-denuded; tarsus nearly twice as long as middle toe and claw; covering of legs skinny. Feet 4-toed; the front toes full-webbed, hind toe short, free. Body remarkably depressed and feathered underneath with thick duck-like plumage; altogether, as in swimming rather than as in wading birds. It is a modification

like that seen in the lobe-footed phalaropes. Sexes and young alike; winter and summer plumage different (in the North American species at any rate).

600. **R. america/na.** (Lat. *americana*, American. Fig. 424.) American Avocet. Blue-stocking. Adult ♂ ♀, *in summer*: White, changing gradually to cinnamon or chestnut-brown on neck and head, excepting, usually, the parts about base of bill. Interscapulars and part of the scapulars black; wings black, with the lining, and most of the secondaries, white. Tail pearl-gray. Iris red (sometimes brown). Legs dull blue (drying blackish), much of the webs flesh color; bill black, often pale at base below. Size extremely variable: length 16.00–20.00; extent 28.00–38.00! wing 7.00–9.50; tail 3.00–4.00; bill 3.50, more or less, from nearly straight to strongly recurved and hooked; tibiæ bare 2.50; tarsus 3.50 or more; middle toe and claw 2.00 or less. Adult ♂ ♀, *in winter*: Head and neck ashy or pearl-gray, like the tail; this has been called *R. occidentalis;* afterward considered the young. *Young:* The head and neck strongly washed with cinnamon-brown; rusty or tawny edgings of the black feathers. I have shot scarcely fledged birds in this state; the shank is also peculiarly swollen. U. S. and British Provinces; rare now in E. U. S., only casual in New England; abounding in the west, especially in the alkaline regions, as those of the Yellowstone and Milk River regions, Utah, etc. Its appearance is striking, as might be supposed; its clamor is incessant when the breeding places are invaded. It is not a wary bird, and may easily be approached when wading about in small flocks in the shallow alkaline pools it loves so well. Feeds by immersing the head and neck for some moments whilst probing about with the curious bill in the soft slimy ooze. On getting beyond its depth, it swims with perfect ease, and often alights from on wing in deep water. Eggs 3–4, as variable in size, shape, and markings as the parents; from 1.80 to 2.10 long by 1.25 to 1.45 broad; ground color from dark olive to brownish-drab, thence to creamy-brown or buff, like those of Shanghai fowls; pretty uniformly and profusely marked with small sharp spots of different shades of chocolate-brown, with neutral-tint shell-markings; on the buff eggs usually smallest and most numerous, bolder on the olive ones.

Fig. 426. — Stilt. (From Tenney, after Wilson.)

225. **HIMAN/TOPUS.** (Gr. ἱμαντόπους, *himantopous*, strap-leg. Fig. 426.) Stilts. Bill extremely slender, but not flattened, nor turned up, nor hooked; longer than head, rather shorter than tarsus. Wing long and pointed, folding beyond the short and square tail, which is less than half the wing. Legs of unique length and slenderness, the bare part about as long as the wing; tibiæ denuded for a great distance; tarsus about twice as long as toes. Feet 3-toed, semipalmate; but the species scarcely swim. Sexes similar; young different.

601. **H. mexica/nus.** (Lat. *mexicanus*, Mexican. Fig. 427.) Stilt. Long-shanks. Lawyer. Adult ♂ ♀: Mantle, constituted by the interscapulars, scapulars, and wings (above and below) glossy-black, prolonged up the back of the neck and on top and sides of head, embracing the eyes. A spot over and behind eye, one on under eyelid, forehead to opposite eyes, sides of head below eyes, sides of neck and entire under parts, together with the lower back, rump, and upper tail-coverts, white; tail pearl-gray. In life the long black wings fold entirely over the white upper parts and tail, so that the bird looks entirely black above. Bill black; eyes and legs carmine, latter drying yellowish. Length about 15.00; extent about 30.00; wing 8.50–9.50; tail 2.75–3.25; bill 2.50–2.75; tibiæ bare 3.00–3.50; tarsus 4.00–4.50; middle toe and claw 1.75–2.00. Adults, not in perfect dress: Some of the dark parts brown, not glossy-black.

Young: Mantle ashy-brown, each feather edged with whitish; wings black, but some of the quills white-tipped, the edge of the wing white, the coverts edged with pale ochre. Tail not so pearly gray as in the adults, with some irregular dusky markings. Legs probably different (skins afford no criterion). Chick, in down: Bill apparently blackish; legs pale. Under parts white; above, prettily mottled with black, brown, and tawny or orange. U. S. generally, like the avocet rare eastward, abundant in the west, rather more southerly than the avocet. Nest at the water's-edge or on heaped vegetation just above the surface in shallow water; eggs 4, pyriform, 1.60 to 1.85 × 1.15 to 1.25; greenish-drab or pale brownish-olive to dark ochraceous, boldly marked all over with spots and splashes of blackish-brown.

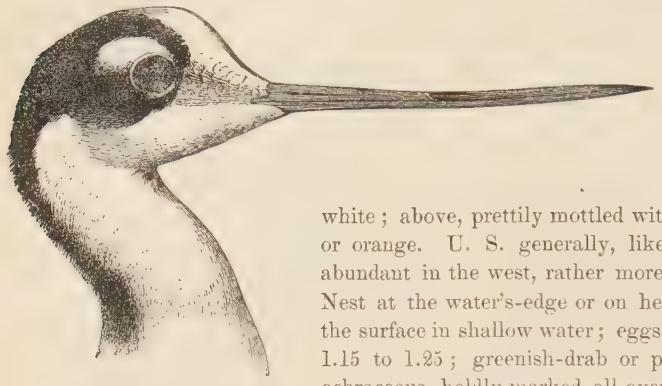


FIG. 427. — Black-necked Stilt, ⅔ nat. size. (From Sclater.)

41. Family PHALAROPODIDÆ: Phalaropes.

This is likewise a small family; the three species comprising it resemble sandpipers, but are immediately distinguished by the lobate feet; the toes are furnished with plain or scalloped membranes, like those of coots and grebes, but not so broad. The body is depressed, and the under plumage thick and duck-like to resist water, on which the birds swim with perfect ease and grace. The wings and tail are like those of ordinary sandpipers; the tarsi are much compressed; there is basal webbing of the toes besides the marginal membrane; the bill, and some other details of form, differ in each of the three genera. These birds inhabit the northern portions of both hemispheres, two of them at least breeding only in boreal regions, but they all wander far southward in winter. There are but three species, one peculiar to America, the others of general distribution.

Analysis of Genera.

Membranes plain; bill very slender, subulate	*Steganopus*	226
Membranes scalloped; bill very slender, subulate	*Lobipes*	227
Membranes scalloped; bill stouter, flattened, with lancet-shaped tip	*Phalaropus*	228

226. **STEGAN'OPUS.** (Gr. στεγανόπους, *steganopous*, web-foot.) FRINGE-FOOT PHALAROPES. Bill long, equalling the tarsus, exceeding the head, extremely slender, terete and acute. Culmen and gonys broad and depressed. Lateral grooves long and narrow, reaching nearly to tip of bill. Interramal space narrow and very short, extending only half way to end of bill. Nostrils at extreme base of bill. Wings of moderate length. Tail short, deeply doubly-emarginate; legs greatly elongated; tibiæ bare for a considerable distance; tarsus exceeding middle toe. Toes long and slender, broadly margined with an even, unscalloped membrane, united but for a brief space basally. Claws moderately long, arched, and acute.

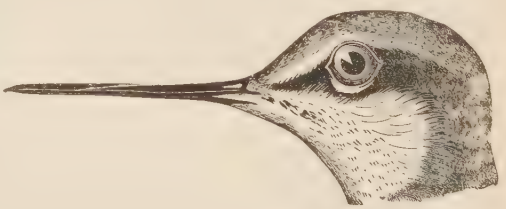


FIG. 428. — Head of Wilson's Phalarope, nat. size. (Ad nat. del. E. C.)

602. **S. wil'soni.** (To A. Wilson. Fig. 428.) WILSON'S PHALAROPE. Adult ♀, in breeding dress: Bill and feet black. Crown of head pale ash, passing into white along a narrow stripe

in the nape. A narrow, distinct, pure white line over the eye. Sides of neck intense purplish-chestnut, or dark wine-red; anteriorly deepening upon the auriculars into velvety-black; posteriorly continued, somewhat duller in tint, as a stripe along each side of the back to the tips of the scapulars. Other upper parts pearly-ash, blanching on the rump and upper tail-coverts. Wings pale grayish-brown; coverts slightly white-tipped; primaries dusky-brown, their shafts brownish-white, except at tip. Tail marbled with pearly-gray and white. All the under parts pure white, but the fore part and sides of the breast washed with pale chestnut-brown, as if with a weak solution of the rich color on the neck, and a faint tinge of the same along the sides of the body to the flanks. Bill and feet black. Iris brown. Length 8.50–9.00; extent 15.50–16.00; wing 5.00–5.25; tail 2.25; bill 1.33; tarsus 1.25; middle toe and claw 1.12. Adult ♂: Less richly colored, and smaller; length 8.00–8.50; extent 15.00; wing 4.75–5.00. Adult ♂ ♀, in winter: No rusty red or pure black. Above, pure ashy-gray, each feather usually skirted with whitish; frequently some blackish, pale-edged feathers. Wing-quills fuscous, usually with light edgings; tail as in summer; upper tail-coverts, line over eye, parts about bill, and whole under parts, white, the jugulum and sides usually shaded with ashy. Young, before first moult: Bill blackish, about 1.10 long; legs dull yellow (tarsus 1.20; middle toe and claw 1.05). Upper parts, including crown and upper surface of wings, brownish-black, each feather edged with rusty-brown, very conspicuous on the long inner secondaries, and giving a general aspect like that of a sandpiper of the genus *Actodromas*. Upper tail-coverts pure white. Tail clear ash, edged and much marbled with white, the ash darker at its line of demarcation from the white. Line over eye, and whole under parts white, the breast with a faint rusty tinge, and the sides slightly marbled with gray. Quills dusky, the secondaries white-edged, and the shafts of the primaries whitish. This stage is of extremely brief duration, beginning to give way, almost as soon the bird is full grown, to the clear uniform ashy of the upper parts of the fall and winter condition. The change, in some specimens shot early in August, is already very evident, clear ashy feathers being mixed, on the crown and all the upper parts, with such as just described. Size of the smallest specimen only 8.25 in length by 14.50 in extent; the wing 4.60. Chicks are covered with buff-colored down, spotted with black above. In full plumage this is the handsomest and largest of the phalaropes, and one of the most elegant of the waders. U. S. and British Provinces, N. to the Saskatchewan; rare in U. S. E. of Illinois and Lake Michigan; abundant in the Mississippi Valley at large and westward. Migratory, leaving U. S. in winter; breeds in suitable places throughout its range. Nest in low grassy meadows and marshes. Eggs 3–4, 1.20 to 1.35 long by 1.90 broad, thus elongate pyriform, clay-color to brownish-drab, heavily marked with large splashes and sizeable spots, with numberless specks and scratches, of dark bistre or chocolate-brown; some eggs much less painted than others, in finer pattern; incubated by the ♂.

227. **LO/BIPES.** (Lat. *lobus*, a flap, *pes*, foot.) Lobe-foot Phalaropes. Bill generally as in *Steganopus*, but shorter, basally stouter, and tapering to a very acute, compressed tip; ridge of culmen and gonys less depressed; interramal space longer and broader. Wings long. Tail short, greatly rounded. Legs and feet short; tibiæ denuded for but a brief space; tarsus not longer than middle toe. Toes very broadly margined with a membrane which is scalloped or indented at each joint, and united basally to second joint between outer and middle toe, to first joint between the inner and middle toe; feet thus semipalmate. Claws small and short.

Fig. 429. — Foot of Red-necked Phalarope, nat. size. (Ad nat. del. E. C.)

603. **L. hyperbo/reus.** (Lat. *hyperboreus*, beyond the north wind. Fig. 429.) Northern Phalarope. Red-necked Phalarope. Adult ♂ ♀, in summer: Above, sooty-gray, with lateral stripes of ochraceous or tawny; neck rich rust-red, nearly or quite all around; under parts otherwise white, the sides marked with the color of back. Upper tail-coverts like back,

some lateral ones white. Wings blackish, the ends of the greater coverts broadly white, forming a conspicuous cross-bar, continued on some of the inner secondaries. Bill and feet black. Length 7.00; extent 13.50; wing 4.25–4.50; tail 2.00; bill, tarsus, middle toe and claw, each, under 1.00. Varies much in plumage with age and season, but easily recognized by the small size and generic characters. Chicks in down rich buff above, silvery-gray below; crown mixed black and yellow; a long black stripe down back, another over each hip, one across the rump, and a shoulder-spot. N. hemisphere at large, breeding in Arctic regions, migrating into the tropics sometimes; generally distributed, but especially maritime. Eggs 3–4, June, average 1.20 × 0.80 (from 1.30 × 0.75 to 1.10 × 0.82), very variable in size, shape, and color; greenish-olive, brownish-olive to various drab and buffy shades of ground color, usually very boldly spotted and splashed sometimes in finer pattern, with bistrous, chocolate, and lighter brown.

228. PHALA'ROPUS. (Gr. φαλαρόπους, *phalaropous*, coot-foot.) Coot-foot Phalaropes. Bill scarcely longer than head or tarsus; very stout for this family; much depressed, so broad as to be almost spatulate, the tip only moderately acute, lancet-shaped. Upper mandible with the ridge broad and flattened, its apex arched and decurved, its lateral grooves wide and shallow. Interramal space broad and very long, extending nearly to the end of the bill. Nostrils subbasal, at some distance from the root of the bill. Wings long and pointed. Tail long, rounded, the central rectrices projecting, rather acuminate. Legs and feet much as in *Lobipes*, but the semipalmation of less extent.

604. P. fulica'rius. (Lat. *fulicarius*, coot-like; *fulica*, a coot; *fuligo*, soot.) Coot-footed Tringa. Red Phalarope. Gray Phalarope. Adult ♂ ♀, in summer: Under parts, with sides of neck, and upper tail-coverts, dark purplish or wine-red, with a glaucous bloom. Top of head and around bill, sooty. Sides of head white, this color meeting on nape. Rump white. Back black, all the feathers edged with tawny or rusty-brown. Quills brownish-black, with white shafts and much white at bases of webs; the coverts dark ash, the ends and inner webs of the greater row white; some of the secondaries entirely white. Bill yellowish, with dusky tip; feet yellowish. Length 7.50; extent 14.50; wing 5.00; tail 2.50; bill 0.90; tarsus 0.75; middle toe and claw rather more. Adult ♂ ♀, in winter: Head all around, and entire under parts, white, — with a dusky circumocular area and nuchal crescent, and a wash of ashy along sides of body. Above, nearly uniform ash. Wings ashy-blackish, the white cross-bar very conspicuous; bill mostly dark; feet obscured. A species of circumpolar distribution in summer, wandering far south in winter, chiefly coastwise. Nesting and eggs not distinguishable from those of the last; eggs averaging larger, — 1.15 – 1.30 × 0.90–0.95.

42. Family SCOLOPACIDÆ: Snipe, etc.

Fig. 430. — English Snipe. (From Dixon.)

Snipe and their allies form a well-defined and perfectly natural assemblage, one of the two largest limicoline families, agreeing with Plover in most essential respects, yet well distinguished from the pluvialine birds. In general, the bill is much elongated, frequently several times longer than the head, and in those cases in which it is as short as in plover, it does not show

Fig. 431. — Wilson's Snipe. (From Tenney, after Wilson.)

the particular, somewhat pigeon-like, shape described under *Charadriinæ*, being slender and soft-skinned throughout. It is generally straight, but frequently curved up or down. The nasal grooves, always long and narrow channels, range from one-half to almost the whole length of the bill; similar grooves usually occupy the sides of the under mandible; the interramal space is correspondingly long and narrow, and nearly naked. This length, slenderness, grooving, and peculiar *sensitiveness*, are the prime characteristics of the scolopacine bill. The gape, never ample, is generally very short and narrow, reaching little, if any, beyond the base of the bill. The nostrils are short narrow slits, exposed. The head is completely feathered to the bill (except in one species), at the base of which the ptilosis stops abruptly without forming projecting antiæ. The wings commonly show the thin pointed contour described under *Limicolæ*, but they are occasionally short and rounded. The tail, always short and soft, has as a rule 12 rectrices; in one genus, however, there are from 12 to 26. The crura are rarely feathered to the suffrago. The tarsi are scutellate before and behind, and reticulate on the sides, except in the curlews, where they are scutellate only in front; they are probably never entirely reticulate (the normal state in plover). The hallux is absent in only two or three instances; the anterior toes commonly show one basal web, and often two, but in many species they are entirely cleft. The scolopacine birds are of medium and small size, ranking with plover in this respect; none attain the average stature of *Herodiones*.

The general economy of these birds is similar to that of plover; a chief peculiarity being probably their mode of procuring food, by feeling for it, in the majority of cases, in the sand or mud with their delicately sensitive, probe-like bill. The eggs are commonly four, parti-colored, pointed at one end and broad at the other, placed with the small ends together in a slight nest or mere depression on the ground; the young run about at birth. The sexes, with very rare exceptions, are alike in color or nearly so, and the ♀ is usually a little larger than the ♂; but the sexual distinctions are very rarely strong enough to be perfectly reliable (remarkable exception in *Machetes*). Color distinctions with age, likewise, are rarely marked; but on the contrary, seasonal plumages are in many cases, as throughout the sandpipers, very strongly indicated, the nuptial dress being entirely different from that worn the rest of the year. Excepting a few species that frequent dry open places like many plover, these birds are found by the water's edge where the ground is soft and oozy — in moist thickets, low rank meadows, bogs and marshes, by the riverside, and on the seashore. Some are solitary, but the majority are gregarious when not breeding, and many gather in immense flocks, especially during the extensive migrations that nearly all perform. The voice is a mellow pipe, a sharp bleat, or a harsh scream, according to the species. Few birds surpass the snipe in sapid quality of flesh, and many kinds rank high in the estimation of the sportsman and epicure. The family is cosmopolitan, but the majority inhabit the northern hemisphere, breeding in boreal regions. There are about ninety well-determined species of scolopacine birds, referable perhaps to fifteen tenable genera, although many more than this are often employed. Various attempts to divide the group into sub-families have met with little success, owing to the close intergradation of the several types. All the leading forms of the family, with most of the lesser genera, are represented in this country, and are indicated by the specific descriptions given beyond; while its entire composition may be pointed out and rendered perfectly intelligible by a brief summary: —

a. In *Woodcock* (*Scolopax* and *Philohela*) and *true Snipe* (*Gallinago*) the ear appears below and not behind the eye, which is placed far back and high up; and if the brain be examined, it will be found curiously tilted over so that its anatomical base looks forward. The bill is perfectly straight and much longer than the head, deep-grooved to the very end, which is either knobbed, or widened just behind the tip, where there is a furrow in the flattened culmen. The membranous covering is abundantly supplied with nerves; this organ constitutes a probe of delicate sensibility, an efficient instrument of touch, used to feel for food below the

surface of the ground. In the dried state, the soft skin shrinks tight like parchment to the bone, and becomes studded with small pits. The gape of the mouth is extremely short and narrow; the toes are cleft; the legs, neck, and wings are comparatively short, and the body is rather full. There are no obvious seasonal or sexual differences in plumage. Not completely gregarious; no such flights of woodcock and true snipe occur as are usually witnessed among sandpipers and bay-snipe; they inhabit the bog and brake rather than the open waterside: they cannot be treacherously massacred by scores, like some of their relatives; they are knowing birds, if their brains are upset, and their successful pursuit calls into action all the better qualities of the true sportsman. There is but one species of *Philohela;* two or three of *Scolopax,* and about twenty of *Gallinago.* The curious circumstance occurs, among the latter, that the tail-feathers range from 12 to 26 in different species; and in those with the higher numbers, several pairs are narrow and linear — a character upon which the genus

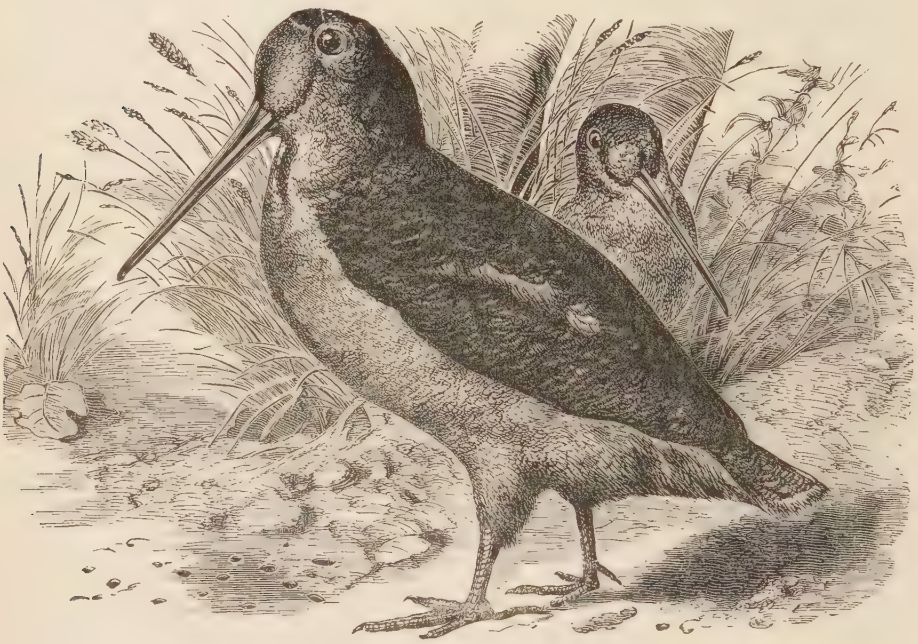


FIG. 432. — American Woodcock, about $\frac{2}{3}$ nat. size. (From American Field.)

Spilura rests.— The singular genus *Rhynchæa,* with two species, *R. capensis* (Africa) and *R. semicollaris* (S. America), may belong here. — *Macrorhamphus,* containing only our species, and one other, *M. semipalmatus* of the Old World, has a bill exactly as in *Gallinago,* but is distinguished by more pointed wings, and differently proportioned legs, with basal webbing of the toes. It stands exactly between the true snipe and

b. The *Godwits* (*Limosa*), in which we find the same very long, wholly grooved, and extremely sensitive bill, which, however, is not dilated at the end, nor furrowed on the culmen, and is bent *slightly* upward; the gape, as before, is exceedingly constricted. The toes show a basal web. These are rather large birds, with the colors and general aspect of curlews, but the bill is not decurved and the tarsi are scutellate behind. They frequent marshes, bays and estuaries, and are among the miscellaneous assortment of birds that are collectively designated "bay-snipe." There are only five or six species, of the single genus *Limosa.*

The *Terekia cinerea* of various parts of the Old World, with the bill recurved almost as in an avocet, stands between the godwits and tattlers.

c. The *Sandpipers* (*Tringa*, etc.) are a rather extensive group, notable for the variation in minor details of form, that it shows with almost every species — a circumstance that has caused the erection of a number of unnecessary genera. Here the bill retains much of the sensitiveness of a snipe's, and the gape likewise is much restricted; but the bill is much shorter, averaging about equal to the head. One trivial circumstance affords a good clue to this group: the tail-feathers are plain-colored, or with simple edgings, while in *almost* all the species of other groups these feathers are barred crosswise. In this group the seasonal changes of plumage are very great; the proportions of the legs, and webbing of the toes, are variable with the species, but, as a rule, the toes are cleft to the base (not so in *Micropalama* and *Ereunetes*), and four in number (except *Calidris*). The sandpipers belong particularly to the northern hemisphere, and breed in high latitudes; they perform extensive migrations, and in winter spread over most of the world. Among them are the most diminutive of waders.

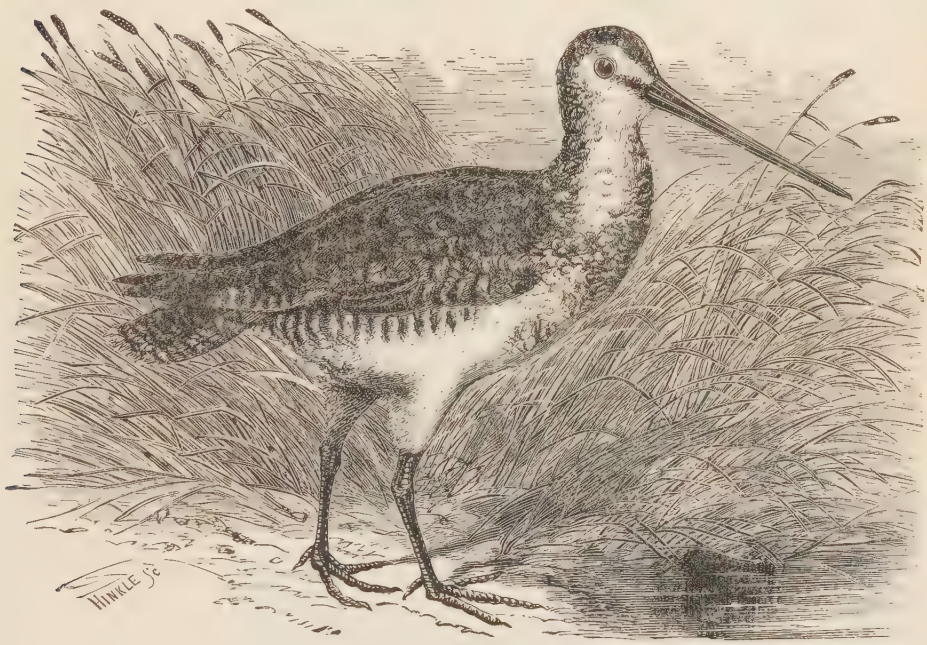


FIG. 433. — American Snipe, about ⅔ nat. size. (From American Field.)

They are probably without exception gregarious, and often fleck the beach in vast multitudes; they live by preference in *open* wet places, rather than in fens and marshes, and feed by probing, like snipe; the voice is mellow and piping. They are pretty well distinguished from both the foregoing, though *Micropalama* connects with the snipe through *Macrorhamphus;* but shade directly into the Tattlers, through such genera as *Tryngites* and *Tringoides.* Nearly all the forms of sandpipers are described in detail beyond. There are in all about 20 species. The only generic form not represented in this country is the *Limicola platyrhyncha*, the peculiarity of which is expressed in its name. The *Eurynorhynchus pygmæus*, a wonderful and exceedingly rare species, in which the bill is expanded and flattened at the end, somewhat as in the spoonbill, has lately been stated to occur on our Arctic coast. The singular *Machetes pugnax* should perhaps rather come here than among

d. The *Tattlers* (*Totanus*, etc.), with which it is ranged, beyond. In this, the largest and most varied group, the bill has comparatively little of the sensitiveness of that of all the foregoing, and the gape is longer, extending obviously beyond the base of the culmen, and sometimes to nearly below the eyes. It varies much in length and shape, but it is *usually* longer than the head, and very slender, not often grooved to the tip, and is either straight, or bent slightly upward. The body and its members are commonly more elongate than in the foregoing, the toes have a basal web or two, and the hinder is always present. The tail is usually barred. These are noisy, restless birds of the marshes and sand-flats and mud-bars of estuaries, and apparently do not probe for food to any extent; they gain their name from their harsh voice. The Yellowshanks is a typical example of the group; most of the species cluster close about this type, and might go in the single genus *Totanus*. The only extra-limital forms are *Æchmorhynchus parvirostris* and *Prosobonia leucoptera*, of the Pacific Islands; curious species apparently near *Tryngites*. There are about 18 species in all, universally distributed. Finally,

e. The *Curlews* (*Numenius*) are distinguished by the downward curvature, extreme slenderness, and usually great length of the bill, with the slight scutellation of the tarsus. In size and general appearance they are near the Godwits; they inhabit all parts of the world. They all belong to the genus *Numenius*, which has about a dozen species — excepting the *Ibidorhyncha struthersi* of Asia, which is a three-toed Curlew, not showing the coloration characteristic of the rest.

Analysis of North American Genera of Scolopacidæ.

Toes 3. (Sandpiper.) . . . . . *Calidris* 240
Toes 4.
Bill spoon-shaped . . . . . *Eurynorhynchus* 241
Bill not spoon-shaped.
One outer primary emarginate, narrowed. (Woodcock.) . . . . . *Scolopax* 230
Three outer primaries emarginate, narrowly linear. (Woodcock.) . . . . . *Philohela* 229
No outer primaries emarginate.
Toes cleft to the base.
Tarsus shorter than middle toe and claw.
Bill about twice as long as head; tibiæ naked below. (Snipe.) . . . . . *Gallinago* 231
Bill little longer than head; tibiæ feathered to the joint. (Sandpiper.) . . . *Arquatella* 236
Tarsus about equal to or longer than middle toe and claw. (Sandpipers.)
Bill slightly curved, longer than head.
Tarsus evidently longer than middle toe and claw . . . . . *Ancylochilus* 238
Tarsus equal to or barely longer than middle toe and claw . . . . . *Pelidna* 237
Bill perfectly straight, much shorter than head. Primaries mottled . . . . *Tryngites* 249
Bill perfectly straight, equal to or longer than head.
Tarsus much longer than middle toe and claw . . . . . *Tringa* 239
Tarsus about equal to middle toe and claw . . . . . *Actodromas* 235
Toes semipalmate, with one or two evident webs.
Tarsus scutellate in front only; bill very long, decurved. (Curlews.) . . . . . *Numenius* 251
Tarsus scutellate in front only; bill barely longer than head, straight . . . . *Heteroscelus* 250
Tarsus scutellate in front and behind.
Tail not barred. One minute web. Primaries mottled . . . . . *Tryngites* 249
Tail not barred. Two full basal webs. Primaries plain. (Sandpipers.)
Bill shorter or scarcely longer than head . . . . . *Ereunetes* 234
Bill much longer than head . . . . . *Micropalama* 233
Tail barred crosswise with light and dark colors.
Gape not reaching beyond base of bill.
Culmen furrowed at end. Under a foot long. (Snipe.) . . . . *Macrorhamphus* 232
Culmen not furrowed. Bill if anything recurved. Over a foot long. (Godwits.) *Limosa* 242
Gape longer. Length under 9 inches. (Tattlers.)
Bill grooved nearly to tip . . . . . *Tringoides* 246
Bill grooved about half-way to tip . . . . . *Rhyacophilus* 245
Gape longer. Length over 9 inches. (Tattlers.)
Bill not longer than head, grooved three-fourths its length.
Tail about half as long as wing . . . . . *Bartramia* 248
Tail not half as long as wing . . . . . *Machetes* 247
Bill longer than head
Legs bluish. Toes semipalmate. Bill stout. (Willet.) . . . . *Symphemia* 243
Legs green or yellow. Bill slender. (Yellowshanks.) . . . . *Totanus* 244

229. **PHILO'HELA.** (Gr. φίλος, *philos*, loving; ἕλος, *helos*, a bog.) AMERICAN WOODCOCK. First *three* primaries emarginate, attenuate and falcate, abruptly shorter and narrower than the 4th. Wings short and rounded; when folded, the primaries hidden by the coverts and inner

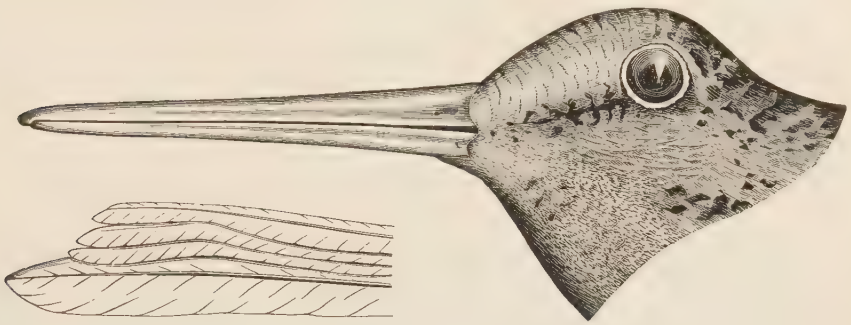


FIG. 434. — Head and attenuate outer 3 primaries of *Philohela*, nat. size. (Ad nat. del. E. C.)

quills. Legs short; tibiæ feathered to the joint; tarsus shorter than middle toe and claw, scutellate before and behind; toes long and slender, cleft to the base. Bill much longer than head, perfectly straight, stout at base, where the ridge rises high, knobbed at end of upper mandible, very deeply grooved nearly all its length, the culmen and line of gonys also furrowed toward end; very soft and sensitive; gape very short and narrow. Head large; neck short; ear under the eye, which is very full, set in back upper corner of the head. Sexes alike; ♀ largest.

605. **P. mi'nor.** (Lat. *minor*, smaller — than the European Woodcock. Figs. 432, 434, 435.) WOODCOCK. BOG-SUCKER. Colors above harmoniously blended and varied black, brown, gray, and russet; below, pale warm brown of variable shade, not barred. A dark stripe from bill to eye. Crown from opposite eye with black and light bars; along the inner edges of the wings a bluish-ashy stripe; lining of wings rust-brown; quills plain fuscous; tail black, spotted, and tipped; bill brownish flesh-color, dusky at end; feet pale reddish flesh-color. The woodcock is 10 or 11 inches long, and 16 or 17 in extent; wing 4.50–4.75; bill 2.50–2.75; tarsus 1.25; middle toe and claw 1.50; and weighs usually 5, 6, or 7 ounces. The woodhen, as some æsthetic market-women prefer to call her, is larger, 11 or 12 inches long; extent 17 or 18; wing 4.75–5.00; bill 2.75–3.00; some good fat ones up to 8 or 9 oz. in weight. Bogs, swamps, wet woodland and fields, Eastern U. S. and Canada; N. to Nova Scotia; N.W. to Minnesota and up the Missouri to Fort Rice;

FIG. 435. — American Woodcock, much reduced. (From Lewis.)

Kansas, Nebraska, Indian Terr. and Texas; no extralimital record; migratory, but breeds throughout its range; winters in the south. This is *the* game bird, after all, say what you please of Snipe, Quail, or Grouse. Eggs more rotund than those of most small waders, corresponding to the plump form of the bird, averaging 1.50 × 1.18; a short broad one 1.40 × 1.20; a long narrow one 1.55 × 1.15; brownish clay-color, more buffy or more grayish, with numberless chocolate-brown surface-markings and stone-gray shell-spots, none very large or bold; size and intensity of markings generally corresponding to depth of ground color; usually laid in April, earlier in the south. The woodcock has many curious actions during the mating season. The young are sometimes removed from danger by the parent, carrying them with the feet. Very erratic and capricious in its movements.

230. **SCO'LOPAX**. (Gr. σκολόπαξ, *skolopax*, Lat. *scolopax*, name of this very bird.) EUROPEAN WOODCOCK. No outer primaries shortened or peculiar, the 1st narrowed somewhat on inner web near end; 1st and 2d longest, 3d little shorter, 4th much shorter; wings long, comparatively, the point of the wing extending beyond the inner secondaries, which only fold about to end of 5th quill. Generic characters, excepting those of the wing, much as in *Philohela*; same style of bill and feet and configuration of body and head; plumage similarly variegated above, but below barred crosswise throughout; size much superior. Of all the snipe-like birds of this country, loosely called "*Scolopax*," this straggler from Europe is the only one to which the name is strictly applicable.

606. **S. rusti'cula**. (Lat. *rusticus*, a rustic; *rusticula*, a little countryman.) EUROPEAN WOODCOCK. Cockbird: Colors above harmoniously blended and varied black, brown, chestnut, and yellowish-gray; under parts brownish-white, regularly wavy-barred throughout with dark brown. A dusky stripe from bill to eye. Top and back of head brownish-black and brown, divided by three or four cross-bars of brownish-white and brown. Each feather of upper parts chestnut and black, in variegation, the black usually forming a large subterminal spot. Yellowish-gray tending to form a scapular stripe on each side of the back. Quills and coverts of wing blackish, pretty regularly varied with dark chestnut bars, on the larger quills this chestnut paler and reduced to marginal indentations; outer web of first primary plain whitish. Upper tail-coverts rich chestnut, little varied with black, with pale tips. Tail-feathers black, with angular chestnut indentations of outer webs; their tips gray from above, viewed from below glistening silvery-white. Under parts brownish-white, more or less suffused with chestnut-brown on the breast, the regular dusky barring only giving way on the whitish throat, changing to lengthwise streaks on the under tail-coverts. Hen: Unmistakably similar — substantially the same; grayer above, much of the russet mottling of the ♂ replaced by hoary-gray. A much "better bird" than our woodcock; a third larger; weight 12–15 oz. Over a foot long; wing seven inches or more; tail 3.50; bill only about as long as in our woodcock; tarsus 1.25; middle toe and claw more. I describe this species with particularity, and sportsmen who get a bird of this sort will do well to report the fact at once. It was formally introduced to our fauna in the original edition of the "Key." There are several authentic instances of its capture in this country, and it is unquestionably entitled to such place, as a straggler from Europe, of which country it is the common woodcock. See Lewis, American Sportsmen, ed. of 1868, p. 169, footnote (New Jersey); Lawrence, Ann. Lyc. Nat. Hist. N. Y., 1866, p. 292 (Rhode Island and New Jersey); Baird, Am. Journ. Sci., xli, 1866, p. 25 (Newfoundland); Coues, Am. Nat., x, 1876, p. 372 (Virginia).

231. **GALLINA'GO**. (Lat. *gallina*, a hen, whence *gallinago*, like *virago* from *vir*.) TRUE SNIPE. Bill much longer than head, perfectly straight, soft to the end, where it is somewhat widened, grooved on top, vascular and sensitive, in the dried state pitted; lateral grooves running more than half-way to tip; gape narrow, not reaching beyond base of culmen. Ear under eye. Tibiæ feathered not quite to the joint. Tarsus a little shorter than middle toe and claw; toes perfectly free, cleft to the base, slender and not fringed. Wings rather short and rounded (for

this family, less so than in *Scolopax* or *Philohela;* no primaries attenuate. Tail short, rounded, of numerous (in our species 16) feathers, of which the lateral are narrowed; tail barred crosswise. Sexes alike; seasonal changes of plumage not pronounced. Numerous species of all countries; one N. American, and another straggling to Greenland from Europe.

Analysis of Species.

Axillars and flanks white, incompletely or imperfectly barred with blackish . . . . . *media* 607
Axillars and flanks fully and regularly barred with white and blackish . . . . . *wilsoni* 608

607. G. me'dia. (Lat. *media*, medium (in size, between two other European species.) Fig. 430.) EUROPEAN SNIPE. "ENGLISH SNIPE" proper. In size, form, and general coloration indistinguishable from No. 608, but the axillary feathers almost entirely white, with slight and sparse dark markings, and the feathers of the flanks and sides less frequently and less regularly barred

FIG. 436. — The Snipe's family. (From "Sport with Gun and Rod." The Century Co., N. Y.)

with dark gray. (In the lesser European Snipe, *G. gallinula*, the sides and lining of wings are fully barred as in our *S. wilsoni*, but the tail-feathers are 14, the outer ones little shorter and not abruptly narrower than the rest.) Europe: Only N. American as occurring in Greenland.

608. G. wil'soni. (To A. Wilson. Figs. 431, 433, 436.) AMERICAN SNIPE. WILSON'S SNIPE. "ENGLISH" SNIPE (so-called). JACK-SNIPE. Adult ♂ ♀: Crown black, with a pale ochrey middle stripe. Upper parts brownish-black, varied with bright bay and tawny, the scapular feathers smoothly and evenly edged with tawny or whitish, forming two lengthwise stripes on each side when the wings are folded. Quills and greater coverts blackish-brown, usually with white tips, and outer web of first primary usually white. Lining of wings and axillars white, fully and regularly barred with black. Rump black, the feathers with white tips. Upper tail-coverts tawny with numerous black bars, and tail-feathers black

basally, then bright chestnut, with a narrow subterminal black bar, their tips fading to whitish; some of the lateral ones white, with little rufous tinge and several instead of one black bar. Belly white; jugulum and fore-breast light brown speckled with dusky brown; chin nearly white; sides of body shaded with brown, and with numerous regular dusky bars throughout; crissum more or less rufous, with numerous dusky bars. Length of ♂ 10.50–11.50; extent 17.50–19.50; wing 4.75–5.25; bill 2.50 (more or less); tail 2.25; tarsus 1.25; middle toe and claw 1.50. ♀ averaging smaller. Weight of various specimens 3 oz. 4 dr. to 4 oz. 3 dr. Bill greenish-gray, dusky on terminal third; iris brown; feet greenish-gray. This is the genuine *snipe*, of all the birds loosely so-called; its name of "English" snipe is a misnomer, as it is indigenous to this country, and distinct from any European species, though closely resembling two of them (*G. media* or *cœlestis* and *G. gallinula*). In our species the tail is normally composed of 16 feathers, the two lateral of which on each side are abruptly smaller, shorter, and much narrower, resembling the under coverts somewhat; and the whole sides of the body from breast to tail, as well as the axillars and lining of the wings, are completely and regularly barred, as is also the crissum. Open wet places of North America, at large; migratory; breeds from N. U. S. northward; S. into S. Amer. in winter, though many remain in U. S. The general habits of this favorite game-bird are too well known to require remark. Eggs 3–4, moderately pyriform, grayish-olive, with more or less brownish shade; markings bold and numerous, most so on the larger end, of varying shades of umber-brown; usually also sharp scratchy lines of black; shell-spots not noticeable. Nest a mere depression in grass or moss of the bog; chicks mottled with white, ashy, ochrey and dark brown.

232. MACRORHAM'PHUS. (Gr. *μακρός*, *makros*, long, *ῥάμφος*, *hramphos*, beak.) WEB-TOED SNIPE. Bill as in *Gallinago*, Wings longer and more pointed, more as in *Tringa*. Tibiæ naked below for a space about half the length of tarsus. Tarsus longer than middle toe and claw. Anterior toes webbed at base; webbing most extensive between middle and outer. Tail doubly-emarginate, of only 12 stiffish (as compared with *Gallinago*) feathers; all the feathers closely and regularly barred. Sexes alike; summer and winter plumages different (as in sandpipers). Thoroughly snipe-like in the bill, but otherwise like long-legged sandpipers; near *Micropalama*, for example. Two alleged species, or varieties.

Analysis of Varieties.

Length 10.00 to 12.50; extent 17.50–20.00; wing 5.30–6.00, average 5.70; bill 2.00–3.00; tarsus 1.25–1.75, average 1.53; middle toe without claw 0.90–1.10, average 1.00.

Wing 5.25–5.90, average 5.65; *bill*, 2.00–2.55, average 2.30; tarsus, average, 1.35; middle toe alone, average 0.95. In summer: Belly whitish; breast and sides speckled with dusky . . . . *griseus* 609

Wing 5.40–6.00, average 5.75; *bill*, 2.20–3.20, average 2.80; tarsus, average, 1.60; middle toe alone, average 1.00. In summer: Belly cinnamon-brown; breast scantily speckled with dusky; sides barred with dusky . . . . . *scolopaceus* 610

Measurements of nine individuals, shot out of one flock in Dakota, formerly supposed to include both species, and to show their perfect gradation in size; now supposed to show individual variation in *M. scolopaceus* alone.

Total length	10.25	10.50	11.00	11.25	11.50	11.75	11.90	12.25	12.50
Extent of wings . . .	17.50	18.00	18.50	19.25	19.00	19.50	19.75	20.25	19.50
Wing	5.40	5.50	5.65	5.80	5.75	5.90	6.00	6.10	5.85
Whole naked leg . .	3.40	3.40	3.40	3.35	4.00	4.10	4.00	4.10	4.15
Bill	2.20	2.40	2.50	2.85	2.90	2.90	2.95	3.05	3.25

609. M. gri'seus. (Lat. *griseus*, gray. Fig. 437.) RED-BREASTED SNIPE (summer). GRAY SNIPE (winter). BROWN-BACK. DOWITCHER. Adult ♀ ♂, in summer: Under parts rich rusty-red, paler or whitish on the belly; jugulum, breast, and sides fully speckled with dusky. Axillars and lining of wings white, with angular dusky markings. Wing-quills fuscous, the shaft of the 1st primary white, of the others brown; secondaries conspicuously tipped with white. Above, black, varied everywhere with the reddish color of the under parts, and on

the back and scapulars with white; the rump snowy-white, unmarked, very conspicuous in flight. Tail and its upper coverts black, closely barred with white or rufous. A dusky line from bill to eye. Bill and feet greenish-black. In winter: Dark gray above, the feathers with dusky centres and pale gray or whitish edges; lower back pure white; superciliary line and spot on under eye-lid white; below, white, the jugulum, fore-breast, and sides heavily shaded with gray, leaving chin whitish; the flanks and crissum with wavy dusky spots or bars. (For dimensions see above.) This variety is supposed to be restricted to E. N. A. (?), along the Atlantic coast, where it abounds during the migration, in proportion of 1,000 to one of the next variety. Breeds in high latitudes. Among the shore birds, this is a great favorite with gunners.

610. **M. g. scolopa'ceus.** (Lat. *scolopaceus*, snipe-like.) WESTERN DOWITCHER. RED-BELLIED SNIPE. GREATER LONG-BEAK. Like the last; averaging larger, the bill especially longer (see above). Weight 2 oz. 7 dr. to 4 oz. 4 dr. Entire under parts rich rusty-red, including belly; throat and breast scantily speckled, sides and flanks thickly barred, with dusky. Winter and immature specimens indistinguishable from the last, excepting those surpassing the maximum size of the latter. N. Am. at large, supposed to be rare or casual on the Atlantic side, and to be the only representative of the genus in the West (?). Like the other, it is abundant; migratory; breeds in high latitudes. Both generally fly in large compact flocks, like the sandpipers and shore-birds generally, rather than singly or in wisps like

FIG. 437. — Bill of *Macrorhamphus griseus*, nat. size, in profile, and its end from above. (Ad nat. del. E. C.)

the true snipe; and prefer the shores of bays and estuaries, instead of wet meadows. Eggs of this variety or the last are not peculiar among their allies; 3–4 in number; length 1.55 to 1.75, by 1.10 to 1.15 broad; ground-color as in *Gallinago*, and general tone and style of markings the same.

233. **MICROPA'LAMA.** (Gr. *μικρός*, *mikros*, small; *παλάμη*, *palame*, a web.) STILT SANDPIPERS. Bill much as in the last genus, but shorter, less evidently widened at the end and not so distinctly furrowed on top, sometimes perceptibly curved. Wings long, pointed, 1st primary longest, rest rapidly graduated. Tail about half as long as wings, slightly doubly-emarginate. Legs very long; tibiæ bare an inch; tarsus as long as the bill. Feet semipalmate, the front toes being connected by two evident basal webs. Plumage resembling that of *Macrorhamphus* in general character; its changes the same; sexes alike. These two genera are perfect links between snipe and sandpipers. One species.

611. **M. himan'topus.** (Gr. *ἱμαντόπους*, *himantopous*, strap-legged. Fig. 438.) STILT SANDPIPER. Adult ♂ ♀, in summer: Above, blackish, each feather edged and tipped with white and tawny or bay, which on the scapulars becomes scalloped. Auriculars chestnut; a dusky line from bill to eye, and a light reddish superciliary one; upper tail-coverts white with dusky bars. Primaries dusky with blackish tips; tail-feathers 12, ashy-gray, their edges and a central field white; under parts mixed reddish, black, and whitish, in streaks on the jugulum, elsewhere in bars; bill and feet greenish-black. Length 8.50–9.00; extent 16.00–17.00;

wing 5.00; tail 2.25; bill 1.50–1.70; tarsus the same; middle toe and claw 1.00; tibia bare 1.00. Young, and adults in winter: Ashy-gray above, with or without traces of black and bay, the feathers usually with white edging; line over the eye and under parts white, the jugulum and sides suffused with the color of the back, and streaked with dusky; legs usually pale greenish-yellow. The full breeding dress is of brief duration; the birds are usually ashy and white from September to April, both inclusive. N. Am., generally: not observed W. of the R. Mts.; rare. Breeds in high latitudes; migrates to W. I. and C. and S. Am.

FIG. 438. — Stilt Sandpiper, in breeding dress, reduced. (From Nuttall, after Swainson.)

234. **ERE'UNE'TES.** (Gr. ἐρευνητής. *ereunetes*, a searcher, prober.) SEMIPALMATED SANDPIPERS. Bill normally about as long as head, straight, quite stout for this family, both mandibles deeply grooved to the expanded vascular and sensitive tip. Wings long, pointed; secondaries obliquely incised. Tail moderate, doubly-emarginate, with pointed and projecting central feathers. Tarsus rather longer than middle toe and claw, equal to the normal bill in length. Bare portion of tibiæ ⅔ as long as tarsus. Toes connected by broad basal webbing, and broadly margined. A true sandpiper, chiefly distinguished from *Tringa* proper by the semipalmate feet (fig. 48); from *Micropalama*, which is similarly webbed, by the shortness of the bill and feet. Very small; sexes alike; summer and winter plumages different.

612. **E. pusil'lus.** (Lat. *pusillus*, puerile, petty). SEMIPALMATED SANDPIPER. PEEP. Bill, tarsus, and middle toe with its claw, *about* equal to each other, an inch *or less* long, but bill very variable, and apt to be shorter — 0.66–0.87; feet semipalmate, with two evident webs; length 5.50–6.50; extent about 11.75; wing 3.25–3.75; tail 2.00, doubly-emarginate, the central feathers projecting. Adult ♂ ♀, in summer: Above, variegated with black, bay, and ashy or white, each feather with a black field, reddish edge and whitish tip; rump, and upper tail-coverts except the lateral ones, blackish. Tail-feathers ashy-gray, the central darker; primaries dusky, the shaft of the first white. A dusky line from bill to eye, and a white superciliary line. Below, pure white, usually rufescent on the breast, and with more or less dusky speckling on the throat, breast, and sides. In winter: Upper parts mostly plain ashy-gray. Young in July and August have scarcely any traces of the spots beneath, being there almost entirely white, with a light buff wash across breast; there is also more white edging of the feathers of the upper parts; but in any plumage and under any variation, the species is known by its small size and semipalmate feet. The extreme variation in the length of the bill is from 0.50 to 1.25, or 86 per cent of the average (0.88). N. Am., everywhere; an abundant and well-known little bird, thronging our beaches during the migrations, which extend to the West Indies and S. Amer. It is only known to breed in high latitudes, though it commonly appears in the U. S. in August, and may sometimes be seen in other summer months. The size, general appearance, and changes of plumage are much the same as those of *Actodromas minutilla*, and the habits of these two birds are very similar. Eggs 3–4, 1.22×0.84, of usual shape; ground from clay-color (usual) to grayish or greenish-drab or decidedly

olivaceous, usually boldly spotted and splashed with umber or chocolate brown, massed at larger end; sometimes more uniformly spotted in smaller pattern.

613. E. p. occidenta/lis? (Lat. *occidentalis*, western.) WESTERN SEMIPALMATED SANDPIPER. An alleged variety, probably untenable, ascribed to Western N. Am.

235. ACTODRO'MAS. (Gr. *ἀκτή, akte*, the seashore; *δρομάς, dromas*, running.) PECTORAL SANDPIPERS. SPOTTY-THROAT SANDPIPERS. Bill about equal to head or tarsus, short, straight, very slender, somewhat compressed, the tip punctulate, scarcely expanded, acute. Grooves on both mandibles very deep, and extending nearly to the tip. Nostrils situated very near the base of the bill. Feathers extending on the lower mandible much beyond those on the upper, and half as far as those between the rami. Wings long, pointed, first primary usually longest; tertials long, slender, flowing. Tail rather long, deeply doubly-emarginate (in one species cuneate), the central feathers much projecting; upper tail-coverts moderately long. Tibia bare for more than half the length of the tarsus; the feathers very short, making the exposed portion nearly as great. Tarsus equal to the middle toe and claw. Toes long, slender, very narrowly margined, entirely free at base. A group of several species, including the smallest representatives of the family, agreeing in form and also in having the jugulum and fore-breast thickly streaked or spotted, usually also with a brownish or ashy suffusion.

Analysis of Species.

Tail graduated, with acuminate feathers.
- Jugulum ruddy brown, with very small sharp dark streaks. Upper tail-coverts and rump with black central field . . . . . *acuminata* 619

Tail not graduated; its feathers, except central pair, not acuminate.
- Jugulum with brownish or ashy suffusion, thickly streaked. Upper tail-coverts and rump with black central field.
  - Largest; length 9.00; wing 5.25. Crown much darker than hind neck, the transition abrupt. Chin immaculate. Edgings of feathers on upper parts light chestnut-red, not making indentations toward the shaft. Suffusion on jugulum very deep, the darker streaks narrow, distinct. Bill and feet dusky-green . . . . . *maculata* 616
  - Medium; length 7.25; wing 4.80. Crown not conspicuously darker than hind neck. Edgings of feathers on upper parts light reddish-yellow, scarcely brighter on the scapulars, making indentations toward the shaft. Suffusion on jugulum very light, the darker markings rounded, somewhat obsolete Bill and feet black. . . . . *bairdi* 615
  - Smallest; a miniature of the preceding; length 5.75; wing 3.40. Edges of feathers chestnut-red, usually more or less indented, their tips lighter. Bill black; legs dusky-green . . . *minutilla* 614
- Jugulum with little or no brownish or ashy suffusion. Upper tail-coverts white.
  - Medium; length 7.50; wing 4.80. Jugulum thickly streaked with narrow dark lines. Upper tail-coverts immaculate, except the outermost Central tail-feathers nearly black . . . *bonapartii* 617
  - Large; length 9.50; wing 5.75. Jugulum thinly marked with oval spots or streaks. Upper tail-coverts with dark arrow-heads. Central tail-feathers scarcely darker than the lateral. . *cooperi* 618

614. A. minutil'la. (Lat. *minutilla*, very minute; dim. of *minutus*, small.) AMERICAN STINT. WILSON'S STINT. LEAST SANDPIPER. PEEP. Smallest of the sandpipers; length 5.50–6.00; extent about 11.00; wing 3.25–3.50; tail 2.00 or less; bill, tarsus, and middle toe with claw, about 0.75. Bill black; legs dusky greenish. Upper parts in summer with each feather blackish centrally, edged with bright bay and tipped with ashy or white; in winter, and in the young, simply ashy. Quills blackish, the shaft of the first white, the secondaries and greater coverts tipped with white. Tail-feathers gray with whitish edges, the central ones blackish, usually with reddish edges. Crown not conspicuously different from hind neck; an indistinct whitish line over eye, and dusky one from eye to bill. Chestnut edgings of scapulars usually scalloped. Below, white; jugulum and sides of body for some distance with ashy or brownish suffusion, thickly spotted and streaked with dusky. This species and the last are usually confounded under the common name of "sandpeeps," and look much alike; but a glance at the toes is sufficient to distinguish them. N., C. and S. America and W. I., anywhere; very abundant during the migrations. Breeds in high latitudes, returning to the U. S. in August. Eggs unknown.

615. A. bair'di. (To S. F. Baird.) BAIRD'S SANDPIPER. Form and proportions typical of the genus. Bill small, slender, rather shorter than the head, equal to the tarsus, the tip scarcely

expanded, its point very acute. Grooves in both mandibles very long and deep, that of the lower very narrow. Feathers extending on the side of lower mandible much farther than those on the upper, about half as far as those between the rami. Wings long; first and second primaries about equal, but varying, third much shorter; tertials long, slender, flowing. Tail rather long, but slightly doubly-emarginate, the central feathers rounded, projecting but little. Toes long, slender, slightly margined, the middle with its claw about equal to tarsus. Adult in breeding plumage: Entire upper parts a very dark brownish-black, deeper on the rump and lighter on the neck behind, each feather bordered and tipped with light reddish-yellow; on the scapulars the tips broader and nearly pure white, and the margins brighter, making several deep indentations towards the shaft. Upper tail-coverts long, extending to within half an inch of the tips of the central tail-feathers, black, except the outer series, which are white with dusky markings. Central tail-feathers brownish-black, the rest successively lighter, and all with a narrow border of white. Jugulum with a very decided light brownish suffusion (much as in *A. maculata*), and, together with the sides under the wings to some distance, with rounded obsolete spots and streaks of dusky. Throat and under parts generally white, immaculate. Bill, legs, and feet black. Young in August: Dimensions and proportions as in the adult. Upper parts a nearly uniform light ashy-brown, deeper on the rump, each feather with a central dark field and with a light edge, these whitish edgings usually conspicuous. Traces of the brownish-black of the adult on the scapulars. Breast and jugulum with the suffusion very light reddish-brown, the streaks sparse and very indistinct. Length 7.00–7.50; extent 15.25–16.50; wing 4.25–4.75; tail 2.25; bill, tarsus, and middle toe with claw, about 0.87. Colors almost exactly as in the last species; edgings of upper plumage rather tawny than chestnut; jugular suffusion pale, rather fulvous, the streaks small and sparse, sometimes almost obsolete. Size of *bonapartii*, but not easy to confound with that white-rumped species. North and South America; rare on the Atlantic coast, common in the interior; the most abundant small sandpiper in some parts of the west, during the migrations. Breeds in Arctic regions; eggs 3–4, 1.30 × 0.92, clay-colored, grayer or more buffy in different specimens, spotted with rich umber and chocolate-browns of varying shades; in some cases the markings fine and innumerable, in others massed at the greater end, sometimes with black tracery also; pale shell-spots usually evident. June, July.

616. A. macula'ta. (Lat. *maculata*, spotted.) PECTORAL SANDPIPER. GRASS-SNIPE. JACK-SNIPE. Bill a little longer than the head, about equal to the tarsus or middle toe, moderately stout, straight or very lightly decurved, the tip more expanded and punctulate than in the type of the genus. Grooves in both mandibles long and deep. Wings long, pointed, first primary decidedly longest; tertials very long, narrow, and flowing. Tarsus equal to middle toe, both about equal to the bill. Tail rather long, deeply doubly-emarginate, the central feathers pointed and greatly projecting. Adult in spring: An ill-defined white line over the eye, and a more distinct one of dusky between eye and bill. Crown streaked with brownish-black and light chestnut, conspicuously different from the neck behind, which is streaked with dusky and light ochreous. Upper parts generally, a very dark brownish-black, every feather edged with ashy or dark chestnut-red, brightest on the scapulars, the tips usually lighter, and the margins never making deep indentations toward the shaft. Rump and upper tail-coverts black, the outer series of the latter white, with sagittate spots of dusky. Primaries deep dusky, almost black, the shaft of the first white, of the others brown. Secondaries and greater coverts dusky, edged and tipped with white. Lesser coverts dusky, fading into light grayish-ash on their edges. Central tail-feathers brownish-black, lighter on their edges, the lateral light ashy, margined with white. Jugulum and breast with a heavy wash of ashy-brown, and with very numerous well-defined streaks of dusky; the suffusion extending on the sides under the wings to some distance, where the dusky streaks are mostly shaft-lines. Chin, and under parts generally, white, immaculate. Bill and feet dusky greenish. Young in September: Edges of the feathers of the upper parts

generally, and of the tertials and central tail-feathers, light bright chestnut, and the tips pure white. Lesser wing-coverts broadly edged and tipped with light ferruginous. Suffusion on the breast and jugulum with a yellowish ochreous tinge not seen in the adult, and the streaks less distinct. Other parts as in the adult. Not known to have a plain ashy and white winter plumage like most sandpipers. Length 9.00–9.50 inches; extent 16.50–18.00; wing (average) 5.50; bill, tarsus, and middle toe with claw about 1.10. N., C. and S. Am., W. I., Greenland, Asia, and Europe; thus of wide and general dispersion; in U. S., chiefly during the migrations, when abundant in wet grassy meadows, muddy ponds and flats, etc. It goes very far north, quite to the Arctic Ocean, and is supposed to breed only in high latitudes; the nest and eggs are still unknown. In some respects of habit it is quite snipe-like; it never flocks on the beaches with the smaller sandpipers, and it has at times a wayward towering flight, like that of a snipe. During the amours, this sandpiper has the power of inflating the throat to a wonderful extent, forming a swelling which hangs like a great goitre upon the breast. 'Pectoral sandpiper' is a book-name, seldom spoken, the bird being better known as the 'grass-snipe,' and 'jack-snipe'; but both these names are objectionable, as it is not a snipe; and 'jack-snipe,' moreover, is the proper name of an English species of *Gallinago* (*G. gallinula*), not found in this country, where *G. wilsoni* sometimes takes the same designation.

617. A. bonapar'tii. (To C. L. Bonaparte.) WHITE-RUMPED SANDPIPER. Bill quite stout, moderately long, equal to the head or tarsus, the tips somewhat expanded. Grooves on both mandibles long and deep. Feathers extending on the lower mandible but little beyond those on the upper. Wings long, pointed, first primary decidedly longest; tertials long, narrow, and flowing. Tail moderate, quite deeply doubly-emarginate, the central feathers somewhat pointed and considerably projecting. Tarsus rather longer than the middle toe. Toes long, slender, and slightly margined. Crown and upper parts generally light brownish-ash, each feather with a large field of dusky towards its end, and on the crown and middle of the back edged with light yellowish-red, deepening into bright sienna on the scapulars. Lesser wing-coverts dark brownish-ash, fading into light ashy on the edges, and with shaft-lines of blackish. Secondaries and greater coverts light grayish-ash, edged and tipped with white. Tertials very dark brownish-ash, fading into light ashy on the edges. Primaries deep dusky, their shafts white in the central portions, and the innermost edged with white. Rump brownish-black. Upper tail-coverts *white*, their outer series with sagittate spots of dusky. Central tail-feathers brownish-black, the rest very light grayish-ash, broadly edged and tipped with white. Jugulum and breast with a scarcely appreciable wash of light ashy, with numerous, distinct, linear-oblong streaks of dusky brown; these extend as minute dots nearly or quite to the bill, and as narrow shaft-lines along the sides to the vent. Rest of under parts white, immaculate. Lower mandible flesh-colored for half its length; rest of bill, with the legs and feet, black. Length 7.50; extent 15.00; wing 4.80; bill, tarsus and middle toe with claw rather less than 1.00. Young in August: Upper parts a nearly uniform dark ash, the black of the adults showing at intervals, but principally on the scapulars, where also the reddish margins of the feathers are apparent. Jugulum and sides under the wings with an ashy suffusion, more conspicuous than in the adult, but much more restricted, and the streaks more obsolete and indistinct. Central pair of upper tail-coverts usually dusky. Other parts as in the adult. America at large, but not yet observed W. of the R. Mts., nor in Alaska; Greenland, Europe. Breeds from Labrador northward; migratory through the E. U. S.

618. A. coo'peri? (To Wm. Cooper.) COOPER'S SANDPIPER. Bill considerably longer than the head, exceeding the tarsus, straight, rather stout, tip scarcely expanded. Feathers extending on side of lower mandible scarcely further than those on the upper. Wings long, pointed, first primary decidedly longest; tertials moderately long and rather slender. Tail moderate, slightly but decidedly doubly-emarginate, the central feathers projecting. Tarsus rather longer than the middle toe; tibia bare for half the length of the tarsus; toes all long, slender, and slightly

margined. Adult in spring: Upper parts a nearly uniform light grayish-ash, each feather with a central brownish-black field, deepening into pure black on the scapulars, where also the edgings of some of the feathers have a reddish tinge. Tertials sooty-brown, fading into light ashy on the edges. Secondaries and greater coverts dark grayish-ash, edged and broadly tipped with white. Primaries deep dusky, almost black on the outer vanes and at the tips, the innermost edged with white; shafts of all brown at base and black at tip, the central portion being white. Upper tail-coverts white, with sagittate spots of dusky. Tail-feathers ashy-brown, the central pair darkest. Under parts white; the jugulum, breast, and sides of the neck with a slight reddish tinge, and, together with the sides, with numerous streaks and oval spots of dusky, which become large and V-shaped on the flanks. Length 9.50; wing 5.75; tail 2.75; bill 1.25; tarsus 1.12. Long Island; only one specimen known. It is still uncertain whether this is a good species or an unusual state of *T. canutus* or *A. maculata*.

619. **A. acumina'ta**. (Lat. *acuminata*, acuminate.) SHARP-TAILED SANDPIPER. A large species, of the size and with somewhat the general aspect of the pectoral sandpiper. Tail graduated, almost cuneate, all the feathers more or less acuminate, the projecting middle pair particularly so. Bill about as long as head; tarsus equal to middle toe and claw; toes perfectly free. Crown bright chestnut, streaked with black, bounded by decided whitish superciliary lines; different from the hind neck. Upper parts with the pattern of coloration of those of *A. maculata*, the feathers being black, with bright chestnut edges, and many of them also with whitish tips, the edgings not making scallops, and particularly straight and firm on the long tertials. Central field of rump and upper tail-coverts black, scarcely or not varied with reddish tips of the feathers, the sides of this area white with dusky touches. Tail-feathers dusky, the middle ones darker or black, all firmly rimmed about with chestnut, buff, or whitish edging. Primaries blackish, their shafts mostly white; secondaries dusky, successively acquiring white tips and edges; greater coverts dusky, white-tipped. Entire under parts white, more or less suffused on the jugulum, breast, and sides with a light ruddy brown (much as in *Podasocys montanus*), the jugulum alone with a set of small sharp dusky touches, being an extension across the throat of better pronounced streaks of the sides of the head, neck, and breast, leaving the chin definitely pure white. The effect is quite different from that produced by the heavy streaking of *A. maculata*. Bill and feet blackish. Length probably 9.00–9.50; wing 5.25; tail 2.50; bill 1.00; tarsus 1.20; middle toe and claw the same. (Described from several late summer and early fall specimens, taken in Alaska. An Australian specimen before me is smaller (wing under 5.00, etc.), and, excepting the crown, lacks any reddish of the upper parts, all the edgings being simply gray; the ruddy suffusion of the breast is scarcely seen.) An interesting species, widely diffused in the Old World, lately found in Alaska, where it is common in summer in some localities, as Saint Michael's, and where it doubtless breeds; extent of its migration in America, if any, unknown.

236. **ARQUATEL'LA**. (Lat. *arquatella*, dim. of *arquata*, for *arcuata*, bowed.) FEATHER-LEG SANDPIPERS. Bill, tarsus, and middle toe, obviously not of equal lengths. Tarsus shorter than bill or middle toe; tibiæ feathered, the feathers reaching the suffrago. Toes very long, broadly margined, and flattened underneath. Hind toe very short; claws short and blunt. Tail moderate, wedge-shaped. Bill variable, always longer than head, straight or slightly decurved, very slender, much compressed, tip scarcely expanded, groove on lower mandible shallow or obsolete. A generic group established upon the well-known "purple" sandpiper, to which two other species or varieties have recently been added. The following analysis is taken from B. N. O. C., v, 1880, p. 162.

Analysis of Species or Varieties.

Breeding dress: Crown streaked with yellowish-gray, or grayish-white; scapulars and interscapulars irregularly spotted and indented with dull buff, or whitish, and tipped with white; fore-neck distinctly streaked with dusky; breast dull gray, everywhere spotted with darker. *Winter dress:* Back and scapulars sooty-black strongly glossed with purplish; the feathers bordered terminally with dark

plumbeous-gray; fore-neck uniform mouse-gray, or brownish-plumbeous. Wing 5.06; culmen 1.20; tarsus 0.99; middle toe without claw 0.90 . . . . . *maritima* 620

Breeding dress: Crown streaked with deep rusty; scapulars and interscapulars broadly bordered with bright ferruginous; fore-neck irregularly clouded with dull pale buff or soiled white and sooty-plumbeous, the breast more coarsely clouded, with more or less of a black patch on each side. *Winter dress:* Like that of *maritima*, but the plumbeous borders of dorsal feathers broader and lighter, or more bluish. Jugulum streaked or otherwise varied with white. Wing 4.86; culmen 1.13; tarsus 0.95; middle toe without claw 0.86 . . . . . *couesi* 621

Breeding dress: Crown broadly streaked with ochraceous-buff; scapulars and interscapulars broadly bordered with bright ochraceous-rufous; fore-neck pure white, sparsely streaked with brownish-gray; breast white, streaked anteriorly and clouded posteriorly with dusky, latter forming more or less of a patch on each side. *Winter dress:* Similar to the corresponding stages of each of the foregoing, but very much paler, the whole dorsal aspect being light cinereous, the scapulars and interscapulars with small, nearly concealed, central spots, the wing-coverts very broadly edged with pure white; fore-neck with white largely predominating. Wing 5.16; culmen 1.33; tarsus 0.98; middle toe without claw 0.90 . . . . . *ptilocnemis* 622

620. A. mari'tima. (Lat. *maritima*, maritime.) PURPLE SANDPIPER. Bill little longer than head, much longer than tarsus, straight or nearly so; tibial feathers long, reaching to the joint, though the legs are really bare a little way above; tarsus shorter than middle toe and claw. Length about 9.00; extent about 16.00; wing 5.00; tail 2.66, much rounded; bill 1.20; tarsus 0.90–1.00; middle toe 1.00 or a little more. The breeding dress, little known: Upper parts black, conspicuously varied on the head, neck, back, and scapulars, with chestnut or cinnamon, and pale buff or whitish, the darker reddish colors edging or indenting the sides of the feathers, the paler colors chiefly tipping their ends; the rusty-red also suffusing the sides of the head, separated from the black and reddish crown by a pale or whitish superciliary stripe. A lighter tawny shade invades the jugulum and breast; otherwise, under parts white, streaked on the breast with blackish, elsewhere nebulated with dusky-gray, but no definite blackish area formed. Rump and upper tail-coverts brownish-black, unmarked. Wings plain fuscous, the lesser coverts narrowly, the greater broadly, tipped with white, the secondaries mostly white in increasing amounts from without inwards, and the shaft of the first primary white. Tail-feathers plain dusky. Adult in winter: Entire upper parts a lustrous very dark bluish- or blackish-ash, with purple and violet reflections, and each feather with a lighter border. Greater and lesser wing-coverts, tertials and scapulars edged and tipped with white. Secondaries mostly white. Primaries deep dusky, the shafts dull white except at tip, where they are black. Upper tail-coverts and central tail-feathers brownish-black with purplish reflections, the outer pairs of the former white-barred with dusky. Lateral tail-feathers light ashy. Jugulum and breast bluish-ash, each feather of the latter edged with white, and the ash extending along the sides beneath the wings. Rest of under parts white, immaculate. Legs, feet, and bill at base light flesh-color; rest of bill greenish-black. Most immature birds of the first fall and winter resemble this, but are duller, without the gloss. Young: Upper parts much the color of the adult, but with each feather broadly edged and tipped with light buff or reddish-yellow. Light edging of wing-coverts ashy instead of pure white. Under parts everywhere thickly mottled with ashy and dusky, deepest on the breast and jugulum. Chicks in down are very pretty: grayish-brown, mottled with black, the back, wings, and rump spangled with white points; head grayish-white, tinged with fulvous, variously marked with black; lores with two parallel black stripes; below, grayish-white. A species of circumpolar distribution, breeding and often wintering in Arctic regions; in America S. to the Middle States; chiefly maritime, but also occurring on the Great Lakes. Egg of usual pyriform shape, about 1.40 × 1.00, clay color with olive shade, with large bold markings of rich umber-brown of varying shade, with neutral tint shell-markings; markings over all the surface, but largest and most massed at the greater end.

621. A. coues'i. (To E. Coues.) ALEUTIAN SANDPIPER. Very near the last. The following is the original description, in substance. Breeding dress: Above fuliginous-slate: feathers of

crown, back, and scapulars broadly edged with rusty-ochraceous, or bright cinnamon, the central field of each feather nearly black, much darker than wings or rump, some of the scapulars and interscapulars tipped with white in some specimens. Lesser coverts narrowly, greater coverts broadly, bordered terminally with white; greater coverts broadly tipped with white, forming a conspicuous cross-bar; several inner secondaries chiefly white; the others, also the inner primaries, narrowly skirted and tipped with white. Rump, upper tail-coverts, and middle tail-feathers, uniform fuliginous dusky, the other rectrices paler, or dull cinereous. A conspicuous long whitish superciliary stripe, reaching to nape, and confluent with whitish of under side of head, thus posteriorly bounding a large sooty-brown auricular area; anterior portion of lores, and forehead dull smoky-grayish; neck, jugulum, and breast, dirty whitish, sometimes soiled with dingy buff, and clouded or spotted with dull slate, sooty-plumbeous, or dusky-blackish, this sometimes forming a large patch on each side of breast. Other under parts pure white, the sides with a chain of slaty spots and streaks, the crissum streaked with dusky; lining of wing pure white. Bill and feet brownish-black in the dried skin; iris brown. Winter plumage: Above, soft smoky-plumbeous, the scapulars and interscapulars glossy purplish-dusky centrally, the plumbeous borders of the feathers causing a squamous appearance; head and neck uniform plumbeous, excepting the throat and a supraloral patch, which are streaked whitish; jugulum squamated with white, the breast similarly, but more broadly marked. Wing, tail, and rump, as in summer. Young, first plumage: Scapulars and interscapulars black, broadly bordered with bright rusty and buffy-white, the latter chiefly on the longer outer scapulars and lower back; wing-coverts broadly bordered with buffy-white; pileum streaked black and ochrey; jugulum and breast pale buff, or buffy-white, streaked with dusky. Downy young: Above, bright rusty-fulvous, irregularly mottled with black, the back, wings, and rump flecked with yellowish-white papillæ; head above deep fulvous-brown, striped with velvety black from forehead to occiput, where confluent with a cross-bar of the same; lores with two parallel stripes of same. Lower parts white, distinctly fulvous on sides. Wing 4.50–5.15 inches, average 4.86; culmen 0.98–1.25, average 1.13; tarsus 0.88–1.00, average 0.95; middle toe without claw 0.78–0.90, average 0.86. Aleutian Islands and Coast of Alaska all the year round; extent of migrations unknown, if any.

622. A. ptilocne'mis. (Gr. πτίλον, *ptilon*, a feather; κνημίς, *knemis*, a greave; the crus being feathered.) PRYBILOV SANDPIPER. BLACK-BREASTED SANDPIPER. Different. Adult in breeding dress: With somewhat the appearance of a summer *Pelidna alpina*, but the black area pectoral, not abdominal. Crown, interscapulars, and scapulars black, completely variegated with rich chestnut, ochrey, and whitish, the body of each feather being black, with one or another or all the lighter markings; the coronal separated from the dorsal variegation by a grayish-white, dusky-streaked cervical interval. Lower back, rump, and upper tail-coverts blackish, little variegated with chestnut. Secondaries nearly all pure white, a few of the outermost and innermost touched with grayish-brown near end. Primaries grayish-brown with white shafts except at tip, fading to white on inner webs toward base; several of the inner ones also largely white on outer webs, and tipped with white. Central tail-feathers brownish-black; next pair abruptly paler, grayish; rest white or whitish with pale gray tint. Front and sides of head, superciliary line, tufts of flank-feathers, and entire under parts, white, interrupted on the breast with a large but not well defined nor perfectly continuous blackish area, and marked on the upper breast and sides with a few sharp blackish shaft-lines. A dusky auricular patch. Legs and bill dark. Length apparently about 9.50; wing 4.80–5.30; tail 2.30–2.70; bill 1.10–1.40! tarsus 0.90–1.00; middle toe and claw 1.05–1.20; ♀ averaging less than ♂. Winter plumage as above said. First plumage: Upper parts much as in the adults, but the rusty markings in curved rather than angular lines, and much narrower; edges of wing-coverts ochrey. Interior tail-feathers rusty-edged. Throat and breast more or less suffused with rusty; no black pectoral area, but the jugulum, breast, and sides suffused with rusty. Chicks in down (July):

Below, silvery-white; above, rich reddish-brown, varied with white, with curious little round dots, like mildew. Each such spot is as large as a pin-head, and, under a lens, is seen to be the enlarged brushy end of a down-feather, whence several tiny bristles sprout. Each such plume is white at base, then black, then white-tufted as said; the dotted areas thus correspond to the areas of black variegation, but there are, also, a black undotted frontal line, loral stripes, and some other markings. Only known from the Prybilov or Fur Seal Islands, where it breeds, and northward to St. Matthew and St. Lawrence Islands. Eggs 4, like those of *A. maritima*.

237. PELID'NA. (Gr. πελιδνός, *pelidnos*, gray?) DUNLIN SANDPIPERS. Bill stout, much longer than head or tarsus, slightly decurved, tip somewhat expanded and punctulate; grooves in both mandibles deep and distinct. Wings moderate; tertials long and flowing. Tail moderate, doubly-emarginate, the central feathers projecting. Legs rather long; tarsus not shorter than middle toe and claw, if anything longer. Bare portion of tibia more than half the tarsus. Toes rather long, cleft to the base, narrowly margined. Contains a few species or varieties in summer reddish above, with a great black abdominal area.

Analysis of Varieties.

Smallest: length about 8.00; bill, average, 1.40; tarsus little if any longer than middle toe and claw; tarsus and middle toe together 1.75 . . . . . *alpina* 623
Medium: length about 8.50; bill, average, 1.70; disproportionately longer, stouter, more decurved; tarsus decidedly longer than middle toe and claw; tarsus and middle toe together 2.00 . . . . *americana* 624
[Largest: bill and legs still longer than in the last. Pacific Coast, N. A. . . . . *? pacifica*]

623. P. alpi'na. (Lat. *alpina*, alpine.) EUROPEAN DUNLIN. PURRE. Differing as above said from the N. A. species. Straggler to Greenland.

624. P. a. america'na. (Fig. 439.) AMERICAN DUNLIN. BLACK-BELLIED SANDPIPER. RED-BACKED SANDPIPER. OX-BIRD. Bill longer than head or tarsus, compressed at the base, rather depressed at the end, and usually appreciably decurved. Length 8.00–9.00; extent 15.00; wing 4.50–5.00; tail 2.00–2.33; bill 1.50–1.75; tibiæ bare about 0.50; tarsus 1.00 or rather more; middle toe and claw 1.00 or rather less. Adult in summer: Above, chestnut-red, each feather with a central black field, and most of them tipped with whitish; rump and upper tail-coverts blackish; tail-feathers and wing-coverts ashy-gray, the greater coverts tipped with white; quills dusky with pale shafts; secondaries mostly white, and inner primaries edged with the same; outer webs of primaries blackish, some of the inner ones white-edged toward the base; secondaries mostly white. Under parts white; belly with a broad, jet-black area; breast and jugulum thickly streaked with dusky. Bill and feet black. Adult in winter, and young: Above, plain ashy-gray, with dark shaft lines, with or without red or black traces. Below, white, with little or no trace of black on belly; jugulum with few dusky streaks and an ashy suffusion. White edgings of inner primaries very conspicuous. The summer dress is long worn; it is assumed more or less perfectly in April, and many come from the north still wearing it. All of N. Am., breeding in high latitudes, migrating through and wintering in the U. S., preferably coastwise; common, in flocks on the beaches and elsewhere.

FIG. 439. — Bill and foot of *Pelidna alpina americana*, nat. size. (Ad nat. del. E. C.)

238. ANCYLOCHI'LUS. (Gr. ἀγκυλόχειλος, *agkulocheilos*, having a curved bill.) CURLEW SANDPIPERS. Bill much longer than the head, slender, compressed, considerably decurved, the tip not expanded, and rather hard. Grooves in both mandibles very narrow but distinct. Wings long, pointed. Tail very short, nearly even. Legs long, slender; tarsus and tibia both lengthened, the latter exposed for nearly or quite half the length of the former, which is

nearly as long as the bill. Toes moderate, slender, slightly margined, the middle one about three-fourths the tarsus. One species, noted for its resemblance to a miniature curlew.

625. A. subarqua'tus. (Lat. *subarquatus* or *subarcuatus*, littled curved, as the bill is.) CURLEW SANDPIPER. FERRUGINEOUS SANDPIPER. Adult: Crown of head and entire upper parts lustrous greenish-black, each feather tipped and deeply indented with bright yellowish-red. Wing-coverts ashy-brown, each feather with a dusky shaft-line and reddish edging. Primaries deep dusky, their shafts brown at base and black at tip, the central portion nearly white. Upper tail-coverts white with broad bars of dusky, and tinged at their extremity with reddish. Tail light gray with greenish reflections. Sides of the neck and entire under parts uniform deep brownish-red. Under tail-coverts barred with dusky. Axillars and under wing-coverts white. Bill and legs greenish-black. Young in autumn: Crown of head and back brownish-black, with a slight greenish lustre, each feather edged with white or reddish-yellow. Rump plain dusky; upper tail-coverts white. Wing-coverts with broad grayish-white borders. Tail light ashy, edged and tipped with white, the central feathers with a subterminal dusky border in addition. Under parts entirely white, the breast and sides of the neck finely streaked with dusky, the former with a light buff tinge. Length 8.50; wing 4.90; bill (average) 1.50; tarsus 1.30; toe 0.90; tibia bare 0.70. Inhabits most of the Old World; in America very rare, little more than a straggler along the Atlantic Coast. (For particulars of a dozen or more instances of its occurrence, see New England Bird Life, vol. ii., p. 224.)

239. TRIN'GA. (Lat. *tringa* or *trynga* or *tryngas*, a sandpiper.) ROBIN SANDPIPER. Bill about as long as, or rather longer than, the head, straight, stout, somewhat compressed, widening uniformly from the middle to the slightly expanded, rather hard tip; the culmen depressed on the terminal half to the expansion at tip, and obsoletely furrowed. Both mandibles deeply grooved to the tip. Nostrils very large and placed far forward in the upper groove. Feathers extending on the lower mandible much further than on the upper, and nearly as far as those between the rami. Wings long, pointed, first primary decidedly longest. Secondaries moderately incised. Tertials short, broad, and comparatively stiff. Tail rather short, nearly even, the central feathers projecting but little if any. Legs short and very stout; tarsus usually shorter than the bill; longer than the middle toe. Tibial feathers reaching nearly to joint; tibiæ bare for nearly two-thirds the tarsus. Toes very short and stout, free at base, widely margined; outer lateral longer than inner. Hind toe present, well developed. Claws short, stout, blunt, much curved, dilated on the inner edge. Size large, form stout.

626. T. canu'tus. (Named for King Canute.) RED-BREASTED SANDPIPER. ASH-COLORED SANDPIPER. GRAY-BACK. ROBIN-SNIPE. KNOT. Largest of North American *Tringeæ*. Bill stout, straight, rather longer than the head, upper mandible widely and deeply grooved to the expansion at tip. Feathers extending on lower mandible much farther than on upper, and nearly as far as those between the rami. First primary decidedly longest; tail short, nearly even; legs short, stout; tarsus usually shorter than the bill, but much exceeding the middle toe. Adult in summer: Upper parts brownish-black, each feather broadly tipped and edged with ashy-white, tinged with reddish-yellow on the scapulars. Rump dark ash, barred with dusky; upper tail-coverts white, with transverse sagittate or crescentic bars of brownish-black. Tail grayish-ash, edged with ashy-white. Outer webs and tips of primaries deep dusky, the inner much lighter. Secondaries and coverts grayish-ash, broadly edged and tipped with ashy-white. Line over the eye and entire under parts uniform brownish-red, fading into white on the flanks and under tail-coverts, which latter are marked with sagittate spots of dusky. Bill and feet greenish-black. Young in autumn: Upper parts a uniform dark ash, or cinereous, each feather tipped with ashy or pure white, and having a subterminal edging of dusky-black, producing a conspicuous set of black and white semicircles, very characteristic of the species in this plumage. Indistinct line over the eye, and whole under parts, white, more or less tinged with light reddish, the throat, breast, and sides with rather sparse, irregularly

disposed lines and spots of dusky, which become transverse waved bars on the latter. Length 10.50; extent 20.50; wing 6.40; tail 2.70; bill about 1.40; tarsus 1.20; middle toe 1.00; tibia bare 0.60. A large handsome species, inhabiting most of the World; in America, chiefly along the Atlantic coast, but also in the interior, about the large lakes and rivers. Migratory; breeds only in high latitudes.

240. **CALI'DRIS.** (Gr. καλίδρις, *kalidris*, Lat. *calidris*, name of some beach bird, perhaps this one.) SANDERLINGS. Bill stout, straight, about as long as head or tarsus; tip thickened, expanded and rather hard, the culmen just behind it somewhat concave. Nostrils far forward. Wings long, pointed; tail short, doubly-emarginate, central feathers projecting. Tibiæ bare for two-thirds the length of the tarsus; toes very short, widely margined. *No hind toe* (General characters of *Tringa* proper, but 3-toed. See fig. 39.) One species.

FIG. 440.—Sanderling, ½ nat. size. (From Brehm.)

627. **C. arena'ria.** (Lat. *arenaria*, relating to *arena*, sand. Fig. 440.) SANDERLING. RUDDY "PLOVER." Adult in summer: Entire upper parts and neck all round variegated with black, light ashy and bright reddish; on the back and scapulars each feather having a central black field, and being broadly margined and tipped with ashy or reddish. Under parts white, immaculate. Outer webs and tips of primaries deep brownish-black, inner light ashy. A white spot at base of inner primaries. Secondaries mostly pure white; the outer vanes and part of inner on the latter half dusky. Greater coverts dusky, broadly tipped and narrowly edged with pure white. Rump, upper tail-coverts and central tail-feathers dusky, tipped and narrowly edged with ashy-white; lateral tail-feathers very light ash, nearly white. Bill and feet black. Length 7.50-8.00; extent 15.00–16.00; wing 4.90; tail 2.25; bill about 1.00; tarsus rather

less; middle toe and claw 0.75. Young in autumn: No traces of the reddish. Upper parts very light ash, each feather fading into white on the edges, and with a narrow shaft-line of dusky. Entire under parts pure white. Scapulars dusky, edged with whitish. Other parts as in summer adults. In a usual winter dress, there are traces of the reddish on the upper parts generally, and on the breast. Each feather above is brownish-black, regularly indented and tipped with ashy-white, thus giving to the upper parts the appearance of being evenly mottled. There is a buff tinge on the breast, and also on the tips of the rump-feathers. The bend of the wing is nearly as dark as in the adult. At all times the under parts from the jugulum are pure white. Inhabits the sea coasts of nearly all countries; N. A. at large, abundant coastwise, also in the interior on large bodies of water. Migratory; breeds in high latitudes.

241. EURYNORHYN'CHUS. (Gr. *εὐρύνω, euruno*, I dilate; *ῥύγχος, hrugchos*, beak.) SPOON-BILLED SANDPIPER. Bill about as long as head, straight, spatulate at end, the "spoon" being about as wide as long, lozenge-shaped, with the distal angle well marked, the lateral angles rounded off, the proximal one of course running into the rest of the bill: both mandibles share this extraordinary dilation to about equal extent. The shape is not exactly as in the accompanying sketch; but the expansion is remarkably vascular, doubtless changes somewhat in drying, and may not be quite alike in different specimens. Excepting this prodigy of a bill, the characters are those of ordinary sandpipers, especially the smaller species of *Actodromas*. Toes entirely free; hind toe extremely small; middle toe and claw a little shorter than tarsus. One species.

884. (addenda) **E. pygmæ'us.** (Lat. *pygmæus*, dwarf. Fig. 441.) SPOON-BILLED SANDPIPER. Adult ♀, in breeding plumage: General appearance of a stint (as *Actodromas minutilla*, for example), and size little greater. Coloration of upper parts almost exactly as in the species just named, the feathers being black, with indented light chestnut-red edgings, and mostly grayish-white tips; crown simply streaked with the reddish color and black. Under parts white, the whole throat, breast, and sides of the neck overlaid with bright chestnut (as in a highly-plumaged sanderling), the breast, back of this colored area, and the sides of the body, spotted with dusky. Primaries plain dusky, with blackish outer webs and ends, and mostly white shafts; secondaries mostly white from the base; greater coverts white-tipped. Bill and feet black. Length probably 6.00; wing 3.90; tail almost gone, probably 1.75; tarsus 0.90; middle toe and claw 0.80; bill 0.90, the spoon 0.45 wide; this singular instrument probably acting as a sifter or strainer rather than as a shovel, in dabbling in soft mire. (Described from No. 92,281, Mus. Smiths. Inst., Plover Bay, E. Siberia, June 26, 1881, E. W. Nelson, figured in colors in Nelson's Birds of Bering Sea, etc., Voyage of the 'Corwin.' Washington, 4to. 1883, p. 87. Only one other specimen in this plumage is known to exist; figured in Ibis, 1869, p. 462, pl. 12; see also P. Z. S. 1871, p. 111. A plain ashy and white plumage is more usual.) Asia, especially India, breeding on the eastern Arctic coast of Siberia, and also on the Arctic coast of Alaska; one of the rarest of birds in collections, only some 25–30 specimens being known, mostly from India; in this country, there is probably at present scarcely another specimen known than the one here described.

FIG. 441. — Spoonbilled Sandpiper, nat. size. (By Shufeldt, from Ridgway, after nature.)

242. LIMO'SA. (Lat. *limosa*, muddy, miry; *limus*, mud, slime.) GODWITS. Bill much longer than head, longer than tarsus, curved a little upward. Culmen flattened toward end, but not furrowed: end of bill not notably enlarged or punctulated. Lateral groove of both mandibles

reaching nearly to end of bill; symphyseal groove less extended. Gape of mouth moderate, scarcely cleft beyond base of culmen, as in Snipes and Sandpipers, not as usual among Tattlers. Wing long and pointed; tail short and square. Tibia denuded below for a moderate space. Tarsus longer than middle toe and claw, scutellate before and behind, reticulate on sides. Toes short and stout, much flattened underneath, and widely margined; outer and middle semi-palmate, inner and middle with a slight web. Size large; general aspect curlew-like, but bill recurved, not decurved. In character of bill approaching Snipes, especially *Macrorhamphus*, to which it is nearly related in some other respects, as seasonal changes of plumage of most species. Sexes similar. Two N. Am. species, and two others, occurring in Alaska and Greenland, from Asia and Europe.

Analysis of Species.

Rump, tail and its upper coverts barred throughout with blackish and rufous. Lining of wings chestnut. No extensive barring on under parts. No great seasonal changes of plumage? Feathers not extending on side of under mandible far beyond those on upper . . . . . *fœda* 628

Rump, tail, and its upper coverts barred throughout with white and black. Lining of wings and axillars white, with dusky marks . . . . . *uropygialis* 631

Rump blackish, upper tail-coverts mostly white, tail black with white base and tip. Under parts in summer intense ferruginous, barred throughout. Lining of wings mostly blackish. Feathers extending on side of lower mandible to a point beyond those on upper . . . . . *hæmastica* 629

Similar to *L. hæmastica*; rump, tail and its coverts substantially the same. Lining of wings and axillars white . . . . . *ægocephala* 630

628. L. fœ'da. (Lat. *fœda*, ugly, ungainly, unseemly. Fig. 442.) GREAT MARBLED GODWIT. MARLIN. Feathers not extending on side of lower mandible to a point far beyond those on upper. No white anywhere; rump, tail, and its coverts barred throughout with blackish and the body-color. Lining of wings chestnut; axillars the same, more or less barred with black. General color rufous or light dull cinnamon-red, uniform and nearly uninterrupted on all the under parts, richer and more chestnut on the lining of the wings and axillars; somewhat marked with dusky on the sides of the breast and body; on the whole upper parts variegated with the brownish-black central field of each feather, the blackish predominating, leaving the rufous chiefly as scallops and tips of the feathers. This rufous very variable in intensity; usually paler on upper than on under parts, and strongest under the wings. Primaries rufous, successively darkening from last to first, the outer webs and ends of the few outer ones blackish, the shaft of the first white. Bill livid flesh-colored, blackish on about terminal third; legs ashy-blackish. Large: length 16.00–22.00 inches; extent 30.00–40.00; wing somewhere about 9.00; tail 3.00–4.00; bill 3.50–5.50, generally about 4.00; tarsus 3.00, more or less; middle toe and claw 1.50; few birds vary more in size. Sexes not distinguishable; no ashy and whitish plumage known. Temperate N. Am; the largest of the "bay-birds" excepting the long-billed curlew; conspicuous by its size and red color among the waders that throng the shores and muddy or sandy bars of bays and estuaries during the migration. Known to breed chiefly in the upper Mississippi and Eastern Missouri regions, in Iowa, Minnesota, and Dakota, to the Saskatchewan; does not appear to go far along the Atlantic coast northward. Nests anywhere on the prairie, not necessarily near water; eggs 3–4, about 2.28 × 1.60, light olive-drab, numerously but not very boldly spotted with various umber-brown shades, and the usual stone-gray shell-spots.

FIG. 442. — Godwit, greatly reduced. (From Tenney, after Audubon.)

629. L. hæmas'tica. (Gr. αἱμαστικός, *haimastikos*, of bloody-red color.) HUDSONIAN GODWIT.

American Black-tailed Godwit. Ring-tailed Marlin. Feathers on side of lower mandible reaching to a point far in advance of those on upper. Rump blackish. Most upper tail-coverts conspicuously white; longest coverts and the tail-feathers black with white bases, those of the tail-feathers most extensive, and the latter also white-tipped. The appearance of the parts connectively is therefore of a black rump, then a broad white bar, then a broad black bar, then a narrow white bar. Lining of wings sooty-blackish, mixed with some white; axillars black. Under parts rich ferruginous or chestnut-red, everywhere crossed with numerous irregular black bars, several on each feather, and usually also crossed, especially behind, with similar white bars, such variegation of black, white, and red most pronounced on the under tail-coverts. Upper parts blackish (brownish-black with greenish gloss), intimately mixed with rufous and ochrey or whitish, these lighter colors forming indentations on the edges of each feather. Primaries blackish, with white shafts and white basal spaces; their coverts the same, with white tips. Bill light, probably orange or reddish, the terminal third black; legs black. Length 14.50–16.50; extent 24.00–26.50; wing 7.50–8.50; tail 3.00–3.50; bill 2.75–3.50; tibia bare 1.00 or more; tarsus 2.25–2.55; middle toe and claw 1.30–1.70. ♀ averages larger than ♂; weight 9.00–9.50 oz.; ♂ 7.50–8.00 oz. Immature or winter specimens: Specific characters of wings and tail much the same. Upper parts dark ash, with black shaft-lines, the back varied more or less with black patches and whitish or rufescent markings.

Fig. 443. — Willet, nat. size. (Ad nat. del. E. C.)

Under parts whitish, more or less rufescent, with traces of black barring. N. Am. generally; C. and S. Am. and W. I.; not noted W. of the R. Mts., and apparently not common anywhere in the U. S.; breeds in high latitudes. The American representative of *L. ægocephala*. Eggs 4, average 2.18 × 1.40, very heavy brownish-olive, with the usual markings.

630. **L. ægoce′phala**. (Gr. *αἰγοκέφαλος*, *aigokephalos*, goat-headed; name of some bird.) European Black-tailed Godwit. Very like the last; characters of rump and tail substantially the same; at once distinguishable by *white* (not black) lining of wings and axillars. Europe, etc.; only American as occurring in Greenland.

631. **L. uropygia′lis**. (Lat. *uropygialis*, relating to *uropygium*, the rump.) White-tailed Godwit. Pacific Bar-tailed Godwit. Rump, tail, and its upper coverts, white, more or less tinged with rufous, barred throughout with black. Lining of wings and axillars white, former varied, latter barred, with dark gray. In summer, upper parts blackish, everywhere varied with rusty-red; head, neck, and under parts rusty-red. In winter, grayish-brown above, the feathers with darker centres and blackish shaft-lines; below, whitish; sides and crissum with sagittate black marks. Averaging less than *L. fœda;* bill 3.50–4.50. A widely distributed Old World species, very near the bar-tailed godwit of Europe, *L. lapponica*, and probably identical with *L. novæ-zealandiæ;* lately ascertained to occur in Alaska, where it is common, and known to breed. Eggs like those of other godwits, 2.22 × 1.47.

243. **SYMPHE′MIA**. (Gr. *σύμφημι*, *sumphemi*, I speak with.) Semipalmate Tattlers. Bill

longer than head, straight, its tip not expanded, knobbed, nor notably sensitive; grooved about half its length only; culmen not furrowed. Gape of mouth reaching beyond base of culmen. Bill much stouter than usual in Tattlers. Legs stout. Feet semipalmate, with decided web between inner and middle as well as outer and middle toes. Tarsus longer than middle toe and claw, scutellate before and behind. (General characters of *Totanus* at large, but bill and feet stout, latter bluish, and toes semipalmate. See fig. 49.) One N. Am. species.

632. S. semipalma'ta. (Lat. *semipalmata*, half-webbed. Fig. 444.) SEMIPALMATED TATTLER. WILLET. Adult ♂ ♀, in summer: Upper parts ashy, confoundedly speckled to greater or less extent with blackish; this sometimes giving the prevailing tone, but in lighter colored cases the blackish restricted to an irregular central field on each feather, throwing out angular processes and tending to become transverse bars. When such dark fields prevail, the upper parts become quite blackish, speckled with ashy-white, like *Totanus melanoleucus*, for example. Furthermore, there is often a slight rufescence. Under parts white, sometimes with a rufous or brownish tinge, the jugulum and breast spotted and streaked, the sides barred or arrow-headed, with brownish-black. Axillars and lining of wing, edge of wing and primary coverts, sooty-blackish. Primaries blackish, with a great space white at base, partly overlaid and concealed by the primary coverts, partly showing conspicuously as a speculum; shafts white along this space. Most secondaries white; most upper tail-coverts white, the shorter ones dark like rump, the longer ones barred like tail. Tail ashy, incompletely barred with blackish; lateral feathers pale, or marbled with white. Bill dark; legs bluish. It is evidently a mistake to describe the willet as merely gray and white. Length about 16.00; wing 8.00; tail 3.00; bill 2.25–2.75; tarsus the same; middle toe and claw 1.67. ♂ ♀ in winter, and young: Character of wing as before. Above, light ashy, nearly or quite uniform; tail corresponding with this gray state; upper tail-coverts white. Below, white, shaded with ashy on the jugulum, breast, and sides. Every stage occurs between the two here described. Temperate N. Am. at large, N. to 56° at least, but chiefly U. S.; breeding throughout its U. S. range, and resident in the Southern States. A large, stout tattler, known at a glance by its white-mirrored black-lined wings and blue legs, too plentiful for such a wary, restless, and noisy bird in marshes for the convenience of gunners, as its shrill reiterated cries, incessant when its breeding places are invaded, alarm the whole neighborhood. Breeds by pairs or in small companies in fresh or salt marshes; nest a slight affair in a tussock of grass or reeds just out of the water; eggs 3–4, 1.90 to 2.12 × 1.45 to 1.55, average 2.00 × 1.50, less pointedly pyriform than usual in this family, brownish or buffy-olive or clay color, boldly and distinctly spotted and splashed with umber-brown shades, little massed at the great end, with the usual shell-markings.

FIG. 444 — Willets. (From Lewis.)

244. TOTANUS. (Ital. *totano*, some bird of this kind.) TATTLERS. Bill longer than head, straight or nearly so, if anything rather bent up than down, very slender, without expansion at tip; furrow on culmen, the lateral grooves little if any more than half its length; gape reaching beyond base of culmen. Wings long, pointed; tail short, even or little rounded, barred in color. Legs very long and slender; tibiæ much denuded below; tarsi longer than middle toe and claw, scutellate before and behind. Toes with decided basal webbing between outer and middle toe, that between inner and middle slight. Legs green or yellow. Numerous species of various parts of the world.

Analysis of Species.

Legs yellow.
- Length over 12; wing over 7; tail 3 or more: bill over 2, bent up a little . . . . . *melanoleucus* 633
- Length under 12; wing under 7; tail under 3; bill under 2, straight . . . . . *flavipes* 331

Legs greenish; size and form nearly as in *T. melanoleucus* . . . . . *glottis* 635

633. T. melanoleu'cus. (Gr. μέλας, *melas*, black; λευκός, *leucos*, white. Fig. 445.) GREATER TELL-TALE. GREATER YELLOW-SHANKS. LONG-LEGGED TATTLER. STONE-SNIPE. Bill

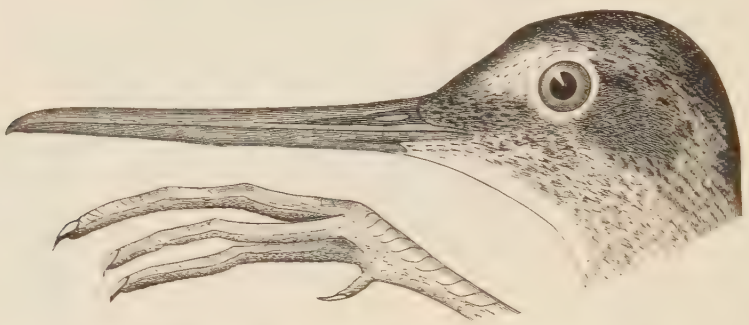


FIG. 445. — Greater Yellow-shanks, nat. size. (Ad nat. del. E. C.)

straight or slightly inclined upward, not with regular curve, but as if bent near the middle black or greenish-black. Legs very long and slender, chrome-yellow. Length 13.00–14.00; extent 23.00–25.00: wing over 7.00, nearer 8.00; tail 3.00 or more; bill 2.00 or more; tarsus about 2.50; middle toe and claw 1.70. Length from end of bill to end of outstretched feet 17 or 18 inches. ♂ ♀, adult: Above, blackish, more or less ashy according to season, everywhere speckled with whitish, in a series of indentations along edge of each feather; the markings spotty on the back and wings, streaky on the head and neck. A slight white superciliary line. Upper tail-coverts mostly white. Under parts white, the jugulum and fore-breast streaked, the sides and flanks, lining of wings and axillars barred and arrow-headed with the color of the back. Tail like back, with numerous white bars, generally broken on the middle feathers. Primaries blackish, with black shafts, mostly with white tips; secondaries and their coverts the same, but their edges marbled, spotted, or broken-barred with white. The seasonal changes of plumage are inconsiderable, consisting chiefly in the tone of the upper parts, more blackish and white in summer, more gray and ashy in winter and in the young; and in the emphasis of the dark markings of the under parts. N. Am. at large; in U. S. chiefly as a migrant, and in winter; breeds in high latitudes; abundant, like the last a noisy, restless denizen of the marshes, bays, and estuaries.

634. T. fla'vipes. (Lat. *flavipes*, yellow-foot.) LESSER TELL-TALE. YELLOW-SHANKS. A miniature of the last: colors precisely the same; legs comparatively longer; bill grooved rather farther, perfectly straight. Length under 12.00, usually 10.00–11.00; extent 19.00–21.00; wing under 7.00; tail 2.50: bill always under 2.00, about 1.50; tarsus about 2.00;

middle toe and claw, and bare tibia, each, 1.25. N. Am., abundant, in the same places as the last. Breeds from the N. States northward, and winters in the U. S. Eggs 3–4, pointedly pyriform, 1.58 to 1.78 × about 1.16; ground clay-color, buffy or creamy, not olivaceous, the markings showing boldly on the pale ground, but in great diversity, some eggs being heavily splashed with blotches confluent about the great end, others having small clean-edged spots all over the surface; markings rich umber, chocolate, or blackish, with neutral-tint shell-spots.

635. T. glot/tis. (Gr. γλῶττα, *glotta*, the tongue; i. e. noisiness.) GREEN-SHANKS. Size and form almost exactly as in *T. melanoleucus;* rather smaller; bill about 2.25; wing 7.50; tail 3.25; tarsus 2.50; colors nearly the same, but bill and legs *greenish;* rump and lower back, as well as the tail and its coverts, white with more or fewer dark marks, chiefly broken bars or other variegation on the tail-feathers alone. "Florida." *T. glottis* AUD., B. Am., 8vo ed., v, 321, pl. 346. There is no reason to suppose that this bird is anything more than a straggler to this country; Audubon's specimen is absolutely identical with European ones.

245. RHYACO/PHILUS. (Gr. ῥύαξ, gen. ῥύακος, *hruax, hruakos*, a brook; φίλος, *philos*, loving.) GREEN TATTLERS. Bill moderately longer than head, perfectly straight, very slender, grooved a little beyond its middle. Legs not very long for this group; tarsus little exceeding middle toe and claw; bill and legs both dark-colored. Only the most rudimentary web between inner and middle toe; a moderate one between outer and middle. Upper parts dark-colored; tail rounded, fully barred with white. Small.

Analysis of Species.

Length over 9.00; upper tail-coverts white; legs grayish-blue . . . . . *ochropus* 636
Length under 9.00; upper tail-coverts like back; legs greenish, drying blackish . . . . . *solitarius* 637

636. R. och/ropus. (Gr. ὠχρός, *ochros*, pale, sallow, wan; πούς, *pous*, foot; not well chosen.) GREEN SANDPIPER. Upper parts blackish-brown, with faint olivaceous metallic gloss, streaked on the head and neck, speckled on the back and wings, with white; upper tail-coverts white. Tail white at base; lateral pair of rectrices white, others marked with white and blackish in bars. Below, white, jugulum and sides marked with dusky. Bill blackish; iris brown; feet grayish-blue, greenish on the joints. Length about 10.00; wing 5.50; tail 2.50; bill 1.50; tarsus 1.30. Nova Scotia; a straggler from Europe (one instance, Bull. Nuttall Club, iii, 1878, p. 49).

637. R. solita/rius. (Lat. *solitarius*, solitary; *solus*, alone. Fig. 446.) SOLITARY TATTLER. AMERICAN GREEN SANDPIPER. ♂ ♀, adult: Above, dark lustrous olive-brown, streaked on the head and neck, elsewhere finely speckled, with white; no continuous white on rump or upper tail-coverts. Below, white; the jugulum and sides of neck shaded with brownish and streaked with dusky; sides, axillars, and lining of wings regularly barred with dusky. Rump and upper tail-coverts like back; tail beautifully and regularly barred throughout with black and white; white prevailing on the outer feathers, where the dark bars may be broken, and white reduced to a series of marginal spots on the middle feathers. Primaries and edge of wing blackish, unmarked; secondaries like back, mostly unmarked, the inner ones gradually gaining white spots. Bill blackish; legs dull greenish (drying quite black, like many scrophulariaceous plants). Length 8.00–9.00, usually between these figures; extent 15.50–17.00; wing 4.75–5.40; tail 2.25; bill 1.12–1.24; tarsus 1.20–1.30; middle toe and claw 1.12–1.20. Young: Above, lighter and less olivaceous brownish, without gloss, the speckling less, or else of a rusty tinge. Suffusion of jugulum paler and more restricted. White around and over eye better defined. Bill and feet ashy-greenish. N. America, the representative of *R. ochropus;* N. to Alaska. Breeds

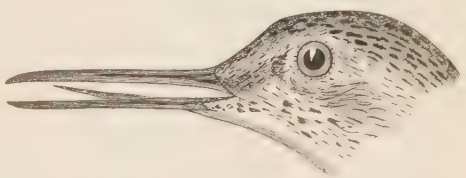


FIG. 446.—Solitary Sandpiper, nat. size. (Ad nat. del. E. C.)

in N. U. S. and northward, if not also through most of its U. S. range; winters altogether or chiefly extralimital. Abundant during the migrations; a shy, quiet inhabitant of wet woods and meadows and secluded pools, rather than of the marshes. Eggs still (1883.!) desiderata; but see Bull. Nuttall Club, iii, 1878, p. 197; New England Bird Life, ii, 1883, p. 240; and Bull. U. S. Nat. Mus. No. 26, p. 97.

246. **TRINGOI'DES**. (Gr. *τρύγγας, truggas*, Lat. *tryngas*, or *tringa*, a sandpiper; *εἶδος, eidos*, resemblance.) Spotted Sandpipers. Bill straight, only about as long as head or tarsus, grooved for about three-fourths its length. Tibiæ scarcely denuded for half the length of tarsus. Tarsus about as long as middle toe and claw. Outer and middle toes webbed for the length of their first joints; inner cleft. Tail fully half as long as the wing. Upper parts glossy, under spotted on white ground; bill and feet pale. Of small size.

638. **T. macula'rius**. (Lat. *macularius*, spotted. Fig. 447.) Spotted Sandpiper. ♂ ♀, adult: Above, silken ashen-olive (quaker-color — as in our cuckoos) with a coppery lustre, finely varied with blackish, in streaks on head and neck, elsewhere in wavy or otherwise irregular cross-bars. Line over eye, and entire under parts, pure white, with numerous sharp circular black spots, larger and more crowded in the ♀ than in the ♂. Secondaries and their coverts broadly white-tipped; some white feathers along bend of wing; axillars and lining of wings white, the latter with an oblique dusky bar. Primaries and most of the secondaries brownish-black, with brown shafts and large white basal spaces, concealed in the folded wing, conspicuous in flight. Upper tail-coverts and middle tail-feathers like back; lateral ones successively acquiring white tips; outer with several incomplete white bars. Feet pinkish-white, drying yellowish. Bill flesh-color, black-tipped; sometimes much of culmen dusky; sometimes much of under mandible orange. ♂: Length 7.25–7.60; extent 13.00–13.50; wing 3.80–4.00; bill, tarsus, and middle toe with claw, each 0.95–1.00. ♀: Length 7.60–7.90; extent 13.50–14.00; wing 3.90-4.10. Young: Above, less glossy, with little if any blackish variegation. Below, white, entirely free from spotting. Downy young: Below, white; above, mottled with dark brown and buff; a sharp black stripe from top of head down middle of back, and another through eye. N. Am. at large, extremely abundant everywhere near water, and breeding throughout the country; winters in Southern States and beyond; familiarly known as the sandlark, peetweet, teeter-tail, tip-up, etc., these last names being given in allusion to its habit (shared by allied species) of jetting the tail as it moves; a custom as marked as the continual bobbing of the head of the solitary tattler and others. Nest a slight affair of dried grasses, on the ground, often in a field or orchard, but generally near water; eggs 4, pointed, creamy or clay-colored, blotched with blackish and neutral tint; about 1.30 × 1.00.

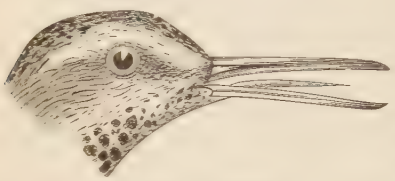


Fig. 447. — Spotted Sandpiper, nat. size. (Ad nat. del. E. C.)

247. **MACHE'TES**. (Gr. *μαχητής, machetes*, a fighter.) Fighting Sandpipers. Bill straight, about as long as head, shorter than tarsus, grooved nearly to tip. Gape reaching behind culmen. Outer and middle toe webbed at base; inner cleft. Tarsus longer than middle toe and claw. Tail about half as long as wing, barred. ♂ in the breeding season with the face bare and beset with papillæ, and the neck with an extravagant frill or ruffle of elongated feathers. ♀ without these ornaments.

639. **M. pug'nax**. (Lat. *pugnax*, pugnacious. Fig. 448.) Ruff, ♂. Reeve, ♀. Combatant. Gambetta. Adult ♂, in wedding dress: Varied above with black, brown, buff and chestnut, the sides of rump white; under parts white, breast and sides and crissum black, spotted with white; tail brown, barred with chestnut and white; quills dusky, with white shafts; wing coverts ashy-brown. Bill blackish, flesh-colored at base; legs dingy yellow; warty excrescences yellow; feathers of the ruff endlessly varied in color. Length about 12.00; wing 7.00;

tail 3.00; bill 1.50; tarsus 2.00. ♀ smaller, lacking the ruff and tubercles, etc. A widely distributed bird of the Old World, noted for its pugnacity; occasionally killed on the coast of New England and the Middle States. (Lawrence, Ann. Lyc. Nat. Hist. N. Y., v, 1852, p. 220, Long Island. Coues, Pr. Essex Inst., v, 1868, p. 296; New England. Brewster, Am. Nat., vi, 1872, p. 306; Massachusetts. Brewster, Bull. Nuttall Club, i, 1876, p. 19; Maine. Wheaton, Bull. Nuttall Club, ii, 1877, p. 83; Ohio. — Forest and Stream, Oct. 7, 1880, p. 186; Massachusetts. See Freke, Zoologist, Sept. 1881, p. 376.)

248. **BARTRA'MIA**. (To Wm. Bartram.) Bill rather shorter than head, much shorter than tarsus, about equal to middle toe; straight, the culmen a little concave in most of its length, the

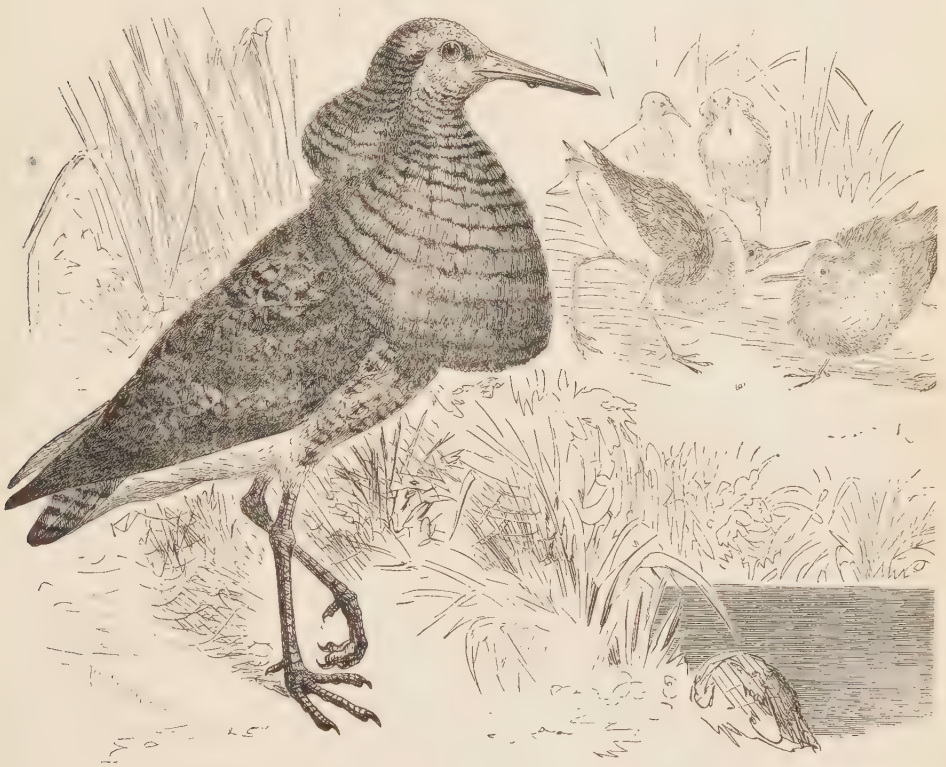


FIG. 448. — The Ruff, ♂, in full feather, ½ nat. size. (From Brehm.)

upper mandible grooved for three-fourths its length. Gape very wide and deep, reaching below eyes. Feathers on side of lower mandible scarcely or not reaching opposite those on upper, and not filling the interramal space. Tail very long, more than one-half the wing, graduated. Wings moderate, pointed. Tibiæ denuded for nearly the length of the middle toe. Tarsi scutellate before and behind, much longer than middle toe and claw. Outer toe moderately webbed; inner cleft to the base. Size medium; neck and legs long; head small; coloration highly variegated; sexes alike; no great seasonal changes. One species.

640 **B. longicau'da**. (Lat. *longus*, long; *cauda*, tail.) BARTRAMIAN SANDPIPER. BARTRAM'S TATTLER. UPLAND PLOVER. FIELD PLOVER. GRASS PLOVER. PRAIRIE PIGEON. Adult ♂ ♀: Above, blackish, intimately variegated with tawny or whitish edgings of all the feathers; blackish prevailing on crown and back, the lighter colors on the hind neck and

wings; on the scapulars and long inner secondaries the black resolved in regular angular bars on a greenish-brown field. Rump and most upper tail-coverts brownish-black, unvaried; a few of the longer coverts barred to correspond with tail. Middle tail-feathers dark ashy-brown, with paler or rufescent edges, and irregular or broken bars, throughout; other tail-feathers becoming orange-brown, with numerous irregular or broken bars or spots of black; with one broad, firm, subterminal black bar, and tips white for a distance increasing on successive feathers. Under parts dull soiled white, or tawny-white, the rufescence strongest on jugulum and breast, the jugulum streaked with blackish, and sides with sharp arrow-heads of the same. Axillars and lining of wings pure white, regularly barred with black. Primaries brownish-black; the 1st at least, and sometimes all of them, barred with white on the inner webs; shaft of the first white, of the others brown. Secondaries like primaries, but usually barred with white on both webs, the inner ones gradually assimilating with the back in character of markings. Bill yellow, with black ridge and tip; feet dull yellowish, drying darker; iris dark brown. Length 11.75–12.75; extent 21.50–23.00; wing 6.25–7.00; tail about 3.50; tarsus 1.75; bill, and middle toe and claw 1.00–1.25. Downy young: Variegated above with white, brown, or black; white below; bill bluish with dark tip; legs clay-color. They are 5 or 6 inches long before any feathers sprout. N. Am. at large, rare W. of the R. Mts., in profusion on the prairies of the interior, and common eastward; N. to the Yukon. Breeds from the middle districts northward; winters extralimital. A fine game bird; but those who only know it when its fears are excited by incessant persecution have little idea what a gentle and confiding creature it is on the western prairies. Nest anywhere on the prairie, in June; eggs normally 4, averaging 1.75 × 1.28; clay-color or pale creamy-brown without olive shade; spotted all over, but most thickly at the large end, with small, sharp, rounded surface marks of umber-brown, among which are the purplish-gray shell-spots; the spots rarely if ever larger than a split pea, and seldom confluent.

249. TRYN'GITES. (Gr. *τρύγγας*, *truggas*, a sandpiper, with suffix *-της*, *-tes*.) MARBLE-WING SANDPIPERS. Bill shorter than head, very slender, tapering, and acute, grooved nearly its whole length, and thus much as in *Tringa;* but gape of mouth extensive, and end of bill not dilated and sensitive. Frontal feathers embracing base of upper mandible in nearly transverse outline, and extending quite to nostrils; those on side of under mandible reaching further still, and those of chin completely filling the interramal space; such extension of the feathers making the bill appear remarkably short. Wings of ordinary shape. Tail about one-half as long as wings, rounded, with projecting central feathers. Tibiæ denuded below for a space less than length of middle toe. Tarsus longer than middle toe and claw. Toes cleft to the base, or with only the most rudimentary basal webbing. Primaries peculiarly marbled in color. Tail not barred. Related to *Tringa* in many respects; but the acute and hardened tip of the bill, and long gape, are totanine, and on the whole the affinities seem to be with the last genus. One species.

641. T. rufes'cens. (Lat. *rufescens*, rufescent, reddish. Fig. 449.) BUFF-BREASTED SANDPIPER. ♂ ♀, adult, in breeding plumage: Above, brownish-black with a greenish gloss, every feather broadly margined with tawny or yellowish-brown, the latter the prevailing tone. Under parts buff or fawn-colored, without markings except a few small blackish spots on sides of breast. Central tail-feathers greenish-brown, blackening at ends; others paler, often rufescent, with white or tawny tips and subterminal black bar; and usually, also, some black marbling or streaking. Primaries and secondaries ashy-brown blackening at end, the extreme tip white — most of the inner webs of the primaries, and both webs of the secondaries pearly white, speckled and marbled with

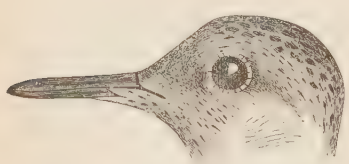


FIG. 449. — Buff-breasted Sandpiper, nat. size. (Ad nat. del. E. C.)

black. This curious tracery, best seen from below, is diagnostic; though the precise pattern varies interminably. The patch of under coverts at the bases of the primaries have the same character. Axillars white; lining of wings white or rufescent. Iris brown. Bill brownish-black; legs greenish or yellowish. Length 7.50–8.25; extent about 16.00; wing 5.00–5.25; tail 2.50; bill along culmen 0.67–0.75, along gape 1.00; tarsus 1.20; middle toe and claw under 1.00. Fall plumage: Under parts less rufescent, frequently simply tawny-whitish; and the broad ochrey or tawny edgings of the feathers of the upper parts replaced by narrow whitish streakings, in a set of semicircles. Wings and tail as in spring. N. Am. at large, and a frequent European straggler, but apparently nowhere abundant; migratory in the U. S.; S. in winter through S. Am.; breeds in high latitudes. Eggs usually 4, pointedly pyriform, 1.40 to 1.50 × 1.02 to 1.10; the ground clay, sometimes slightly olivaceous, often quite grayish; markings extremely bold and sharp, in heavy blotches and indeterminate spots all over the eggs, but largest and most numerous at the greater end; colors rich umber-brown, of varying shade. Nearest these blotched samples are the splashed ones, with markings massed at greater end, elsewhere splattered in small pattern. Others are spotted with narrow markings radiating from the large end, almost wreathing about the greatest diameter. All with the usual neutral-tint shell-markings; most with scratchy blackish marks over all.

250. **HETERO'SCELUS**. (Gr. *ἕτερος, heteros*, different, otherwise; *σκέλος, skelos*, leg.) SHORT-LEGGED TATTLER. Bill totanine, longer than head or tarsus, straight, rather stout, much compressed, both mandibles grooved for about two-thirds their length, with inflected tomia beyond. Gape of mouth extending beyond base of culmen; feathers of equal extent on sides of both mandibles, those of chin reaching much farther. Wings long, pointed, folding about to end of tail; 1st and 2d quills subequal and longest. Tail short, less than half the wing, nearly even. Legs short, somewhat rugous, reticulate except on front of tarsus, where imperfectly or incompletely scutellate; tibiæ denuded for a space about half as long as tarsus; tarsus longer than middle toe and claw, shorter than bill; outer longer than inner lateral toe; a large basal web between outer and middle, a rudimentary one between middle and inner; hind toe long, about equalling 1st joint of inner toe. One species, remarkable for the character of tarsal envelope and perfect uniformity of color of upper parts.

64½. **H. inca'nus**. (Lat. *incanus*, quite gray.) WANDERING TATTLER. Upper parts perfectly uniform dark plumbeous, or slaty-gray, including the wholly unmarked tail, wing-coverts, and inner quills, the longer quills gradually blackening, the shaft of the first primary nearly all white; a white line over eye. Lining of wings, axillars, and sides of body colored like the back, but varied with white. Under parts in general white; in *one* plumage without markings, but heavily shaded on neck, breast, and sides with the color of the back; in *another*, heavily marked with blackish-plumbeous — speckled on throat, streaked on neck, wavy-barred on breast, sides, and crissum. Bill black, apparently pale at base of under mandible. Length about 10.00; wing 6.50; tail 3.00; bill 1.50; tarsus 1.25; middle toe and claw a little less. A species of almost universal distribution on the coast and islands of the Pacific, common in summer on the shores of Alaska; described under at least twelve different names.

FIG. 450. — Long-billed Curlew, greatly reduced.

251. **NUME'NIUS**. (Gr. *νέος, neos*, new; *μήνη, mene*, the moon: the long curved bill, like a crescent. Fig. 450.) CURLEWS. Bill of very variable length, always longer than head, probably always exceeding the tarsus, sometimes more than length of entire leg; slender, curved downward, the tip of the upper mandible knobbed and overhanging the end of the lower; obsoletely grooved nearly to end. Gape of mouth extended beyond base of culmen. Feathers reaching about equally far on sides of each man-

dible. Wings and tail ordinary; latter barred in color. Legs rather stout; tibiæ largely denuded below; tarsus much longer than middle toe and claw, scutellate in front only, elsewhere reticulate. Toes short and thick, flattened underneath, broadly margined on sides. Of large and medium stature, and plump form. Coloration variegated; rufous usually prevailing. Sexes alike; changes of plumage not pronounced. A cosmopolitan genus of several species; in character of bill unique, in that of the legs very similar to *Limosa*. In fact, barring the bill, *Numenius longirostris* closely resembles *Limosa fœda*. It is a curious fact that Old and New World representatives of both these genera differ from each other in a similar manner, the former having the rump, tail and its coverts, and lining of wings white, barred or not, while some or all of these parts in the latter are dark. Compare *Limosa fœda* with *L. uropygialis*; *L. hudsonica* with *L. lapponica*; *Numenius hudsonicus* with *N. phæopus*, etc.

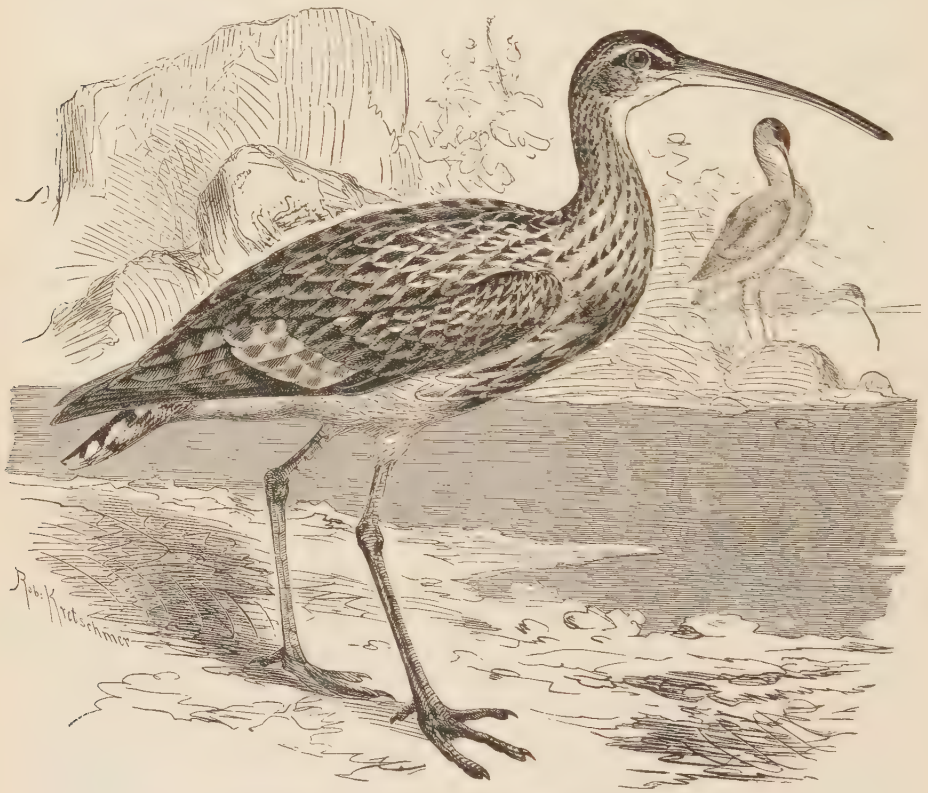


FIG. 451. — The European Curlew, *Numenius arquatus*, ¼ nat. size. (From Brehm.)

Analysis of Species.

Feathers of belly bristle-tipped. . . . . *tahitensis* 647
Feathers of belly normal.
  Rump white, more or less spotted with dusky.
    Upper tail-coverts and under wing-coverts white spotted and barred with dusky . . *phæopus* 644
  Rump, upper tail-coverts and lining of wings not white.
    Primaries varied with rufous. General coloration strongly rufous, especially below: lining of wings deepest rufous, little or not varied. Large: bill 4–6–8 inches . . . . . *longirostris* 643
    Primaries varied with rufous or whitish. General coloration scarcely or not rufous; lining of wings entirely varied. Medium-sized: bill 3–4 inches . . . . . *hudsonicus* 645
    Primaries not varied with rufous or whitish. General coloration scarcely or not rufous; lining of wings entirely varied. Smallest; bill under 3 inches . . . . . *borealis* 646

643. N. longiros'tris. (Lat. *longus*, long; *rostrum*, beak.) LONG-BILLED CURLEW. SICKLE-BILL. Bill of extreme length and curvature, measuring from 4 to 6 or 8 inches. Of largest size: length 24.00 or more; extent 38.00; wing 10.00–12.00; tail about 4.00; tarsus 2.75–3.50. Plumage very similar to that of the godwit, *Limosa fœda:* prevailing tone rufous, of varying intensity in different specimens, usually deepest on the lining of the wings, which are little varied with other color. Primaries varied with rufous. Top of head variegated with blackish and rufous or whitish, without distinct pale median and lateral lines. Upper parts brownish-black, speckled with tawny or cinnamon-brown, each feather having several indentations or broken bars of this color; rufous prevailing on wing-coverts. Tail-feathers and secondaries cinnamon-brown, with pretty regular dark bars throughout. Under parts rufous or cinnamon of varying intensity, usually deepening to chestnut under the wings, fading to whitish on throat; the jugulum and fore-breast with dusky streaks which tend on the sides of breast and body to arrow-heads or more or less complete bars; lining of wings, axillars, and crissum, mostly unmarked, though some spots may appear. No white on rump, tail, or wings. Bill black, much of under mandible pale-flesh-color or yellowish; legs dark. Little variation in plumage with sex, age, or season. Chicks hatch in whitish down, thickly blotched above with brownish-black; the bill straight, an inch long. Like other exceptional developments of parts of birds, this member grows to indeterminate length. Up to the time it is not over 3 or 4 inches long, the species may be distinguished from *N. hudsonicus* by the strong rufescence of the under parts, which are nearly clear of dark markings. Entire temperate N. Am.; breeds nearly throughout its range; migratory northward, resident in the south, but also S. in winter to C. Am.; uncommon in New England. Nests aboundingly on the S. Atlantic coast, and on the prairies of the Northwest. Eggs 3–4, not very pear-shaped, more like hen's eggs; 2.45 to 2.80 long by 1.80–1.90 broad; clay-colored, tending either to darker olivaceous shades or to buff; spotting generally pretty uniform and of small pattern, in some cases blotched or massed at the greater end, of sepia, chocolate, or umber-brown, the paler shell-markings usually numerous and evident.

FIG. 452. — Hudsonian Curlew, much reduced. (From Lewis.)

644. N. phæ'opus. (Gr. *φαιός*, *phaios*, dusky, swarthy; *πούς*, *pous*, foot.) EUROPEAN WHIMBREL. In stature and general character resembling the Hudsonian curlew; at once distinguished from that species by the white rump, upper-tail coverts and lining of wings, spotted or barred with dusky. An extensively distributed Old World species, only N. American as occurring in Greenland.

645. N. hudson'icus. (Of Hudson's Bay. Fig. 452.) HUDSONIAN CURLEW. JACK CURLEW. Of medium size; bill moderate in length, stout, curved. Bill 3 or 4 inches long. Length 16.00–18.00; extent 32.00; wing 9.00–10.00; tail 3.50; tarsus 2.25–2.50. General tone of coloration

scarcely rufous, the under parts, and the variegation of the upper, being whitish or ochraceous. No white on rump, tail, or lining of wings. Top of head uniform blackish-brown, with well-defined whitish median and lateral stripes (as in *phæopus*, but neither *longirostris* nor *borealis*). Upper parts brownish-black, speckled with whitish, ochraceous or *pale* cinnamon-brown, in same pattern as in *longirostris*, but the dark in excess of the light colors, and these never strongly rufescent. Tail ashy-brown (not rufous), with numerous narrow blackish bars. Primaries fuscous, marbled or broken-barred with pale color (pattern as in *longirostris*, tone not strongly rufous). Lining of wings and axillars rufescent, but spotted or barred throughout with dusky. Under parts soiled whitish or somewhat ochraceous, only obscurely rufescent on crissum, if anywhere; the jugulum and fore-breast with dusky streaks which, as in other species, change to arrow-heads or incomplete bars on sides of breast and body. Bill blackish, some part of lower mandible pale; feet dark. The N. Am. representative of *N. phæopus*, but obviously different; generally distributed, not so common as either *longirostris* or *borealis*; breeds in high latitudes, migratory through the U. S., wintering in the S. States and far beyond. Eggs of intermediate size, but not distinguishable with certainty, the markings being as in other species: 2.12 to 2.30 long, by about 1.60 broad.

646. N. borea'lis. (Lat. *borealis*, northern.) Eskimo Curlew. Dough-bird. Of smallest size; bill short, slender, and little curved. Bill 2.00 or more, perhaps never 3.00. Length 12.00–15.00; extent 28.00; wing under 9.00; tail 3.00; tarsus 2.00 or less. General tone little rufescent, the under parts and the variegation of the upper rather ochraceous than rufous. Top of head variegated throughout, without median line, but with tolerably well defined whitish superciliary stripes. Upper parts brownish-black, speckled with ochraceous or very pale cinnamon brown, the general effect as in *hudsonicus*; dark coloration in excess of the pale. Tail barred much as in *hudsonicus*, the broader light bars often rufescent. Primaries and most secondaries *plain fuscous*, entirely lacking the variegation seen in the foregoing. Under parts ochraceous, or somewhat rufescent, very variable, frequently whitish, marked as in other species with dusky streaks, arrow-heads, or bars, but these more numerous, frequently occupying all the under parts, excepting chin and middle of belly. Axillars and lining of wings rufescent, barred throughout with dark brown. Bill black, with base of lower mandible pale or yellowish; feet greenish-black. In handling perhaps a hundred fresh-killed birds, I have noted much variation in tone, but the species is unmistakable. N. Am. at large, breeding within the Arctic circle, migrating through the U. S., where rarely if ever known to winter, never to summer, and wintering in C. and S. Am. Extraordinarily abundant in some places during the migration, as in Labrador, where it fairly swarms in August. In the northern regions, feeds chiefly on the *Empetrum nigrum*. Nest in open plains. Eggs 4, from 1.90 to 2.12 long, by 1.33 to 1.40 broad: olive-drab, tending to green, gray, or brown in different cases, with large, bold and numerous markings of bistre, chocolate and sepia-brown, tending to aggregate on the greater end, with the ordinary stone-gray shell-marks.

647. N. taïten'sis. (Of Otahiti.) Otahiti Curlew. Bristle-bellied Curlew. Of medium size, about equalling *N. phæopus*; wing 9.00 or more; tail 4.00: bill about 3.50: tarsus about 2.25. Crown with light median and superciliary lines; upper parts brownish-black, with the usual tawny variegation; no white on rump, tail, or lining of wings; tail and its coverts tawny, the coverts spotted or streaked with dusky, the rectrices pretty regularly and firmly barred with about 6 dusky bands, and tipped with tawny-white; lining of wings and axillars fully barred with tawny and dusky. Primaries blackish, varied to some extent on inner webs, the shaft of the first white. Under parts pale tawny, the chin white, the jugulum thickly streaked, the sides more loosely barred with dusky, but most of under parts immaculate, and many feathers, especially of the flanks, ending in long glistening bristles. Bill and feet dark. Alaska, not common, perhaps only a straggler from Asia; a well-known and abundant curlew of various Pacific islands, only recently added to our fauna.

VIII. Order HERODIONES: Herons and their Allies.

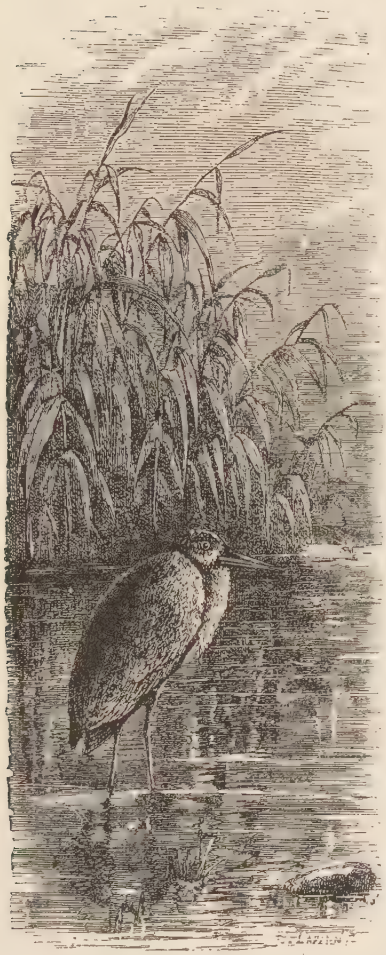


FIG. 453. — The Bittern's Bog. (From Michelet.)

Altricial Grallatores: including the Herons, Storks, Ibises, Spoonbills, and related birds. The species average of large size, some standing among the tallest of Carinate birds, with compressed body and extremely long neck and legs. The neck has usually 15-17 vertebræ, and is capable of very strong flexion in S-shape. The tibiæ are naked below; the podotheca varies. The general pterylosis is peculiar, in the presence, in central groups of this order, of powder-down tracts, and in some other respects. The oil-gland is present, and tufted. A part if not the whole of the head is naked as a rule, as much of the neck also frequently is. The toes, usually long and slender, are never fully webbed. The hallux is more or less lengthened, and either little elevated, or else perfectly insistent. A foot of insessorial character results; the species frequently perch on trees, where the nest is usually placed. The physiological nature is altricial and usually psilopædic; the young hatching naked, unable to stand, and being fed in the nest. The food is fish, reptiles, mollusks, and other animal matters, generally procured by spearing with a quick thrust of the bill, given as the birds stand in wait, or stalk stealthily along; hence they are sometimes called *Gradatores* (stalkers). The bill normally represents the "cultrirostral" pattern; it is as a rule of lengthened wedge shape, hard and acute at end if not hard throughout, with sharp cutting edges; enlarging regularly to the base where the skull contracts gradually in sloping down to meet it; but deviations from such typical shape are frequent and striking. It is firmly affixed to the skull, and always longer than the head. The nostrils are small, elevated, surrounded by bone and a horny sheath, with little if any soft skin. The wings normally show a striking difference from those of *Limicolæ*, in being long, broad, and ample. The tail is short and few-feathered, usually having 12 rectrices.

The cranial characters, though varying to some extent, agree in several important respects. The palatal structure is desmognathous, but without keel along line of junction; the maxillopalatines are large and spongy. The nasal bones are typically holorhinal; schizorhinal in *Ibides;* in which, also, the angle of the mandible is produced and recurved, being normally truncate. The sternum is ample, once or twice notched on each side behind. The cervical vertebræ are numerous; usually 15–17. The trachea and bronchi present some remarkable dispositions, but here and there only, such conformations being therefore not characteristic of the order. The carotids are double (in *Botaurus* (fig. 93) unique, as far as known, in uniting at once). An intestinal cœcum or two cœca, present. Different genera vary in the classificatory muscles of the leg, the ambiens, femoro-caudal, and its accessory being present or absent.

The group here noted corresponds to the *Pelargomorphæ* of Huxley, the *Ciconiiformes* of Garrod (minus *Cathartidæ*), the *Grallatores* [illegible] of Sundevall, and includes the *Herodiæ*, *Pelargi*, and *Hemiglottides* of Nitzsch, — respectively the *Heron* series, the *Stork* series, and the series of *Ibises and Spoonbills*. The first of these differs more from the others than these do from one another. As usual, there are certain outlying genera, types of families or subfamilies, the position of which is not assured. But appearances are that the questionable forms will fall in one or another of the three series indicated. All of these series, to be conventionally rated as suborders or superfamilies, are represented in North America, where also all the large and leading families occur.

12. Suborder IBIDES: The Ibis Series.

Skull schizorhinal. Angle of mandible produced and recurved. Ambiens muscle, femorocaudal and accessory, semitendinosus and accessory, and post-acetabular portion of tensor fasciæ, present; pectoralis major simple; biceps cubiti connected with tensor patagii longus. Sternum double-notched on each side. Carotids double, normal. Two intestinal cœca. Tongue extremely small. A tufted oil-gland. Plumage without powder-down; feathered tracts broad. Tarsi reticulate (rarely scutellate). Hallux not fairly insistent. Claws resting upon a horny "shoe." Inner edge of middle claw not, or not fairly, pectinate. Side of upper mandible with a deep narrow groove for its whole length; bill otherwise very differently shaped in the two families, *Ibididæ* and *Plataleidæ*, of which this series consists.

43. Family IBIDIDÆ: Ibises.

Bill very long and slender, compressed-cylindric, curved throughout, deeply grooved nearly or quite to tip, which is rather obtuse, not notched: end of culmen rather broad and depressed, in the rest of its extent the culmen narrow and rounded: interramal space narrow, acute, produced nearly to tip of bill. (Whole bill thus closely resembling a Curlew's: one of our species is frequently called "Spanish Curlew.") Legs rather short (for *Herodiones*). Claws compressed, acute; the middle may be dilated and jagged, but is not fairly pectinate. Hallux sub-insistent. Tarsi reticulate, or scutellate in front only. Anterior toes more or less webbed at base. Pterylosis more or less completely stork-like, lacking the powder-down tracts of Herons; head more or less extensively denuded. Birds of medium and large size (among *Herodiones*), long-legged, long-necked and small-bodied, with ample more or less rounded wings, of which the inner quills are very large: tail very short, usually if not always of 12 broad rectrices. Chiefly lacustrine and palustrine inhabitants of the warmer parts of the globe, feeding on fish, reptiles, and other animals. The sexes are alike: the young different. There are about 24 species of Ibises, among which the minor details of form vary considerably, nearly every one of them having been made type of some genus, according to shape of bill, character of head-feathering, condition of tarsal envelope, etc. The two leading modifications are, tarsus entirely reticulate, and tarsus scutellate in front: our genera illustrate the latter.

Obs. Our Wood "Ibis," so called, is a Stork. See beyond, p. 652.

Analysis of Genera and Species.

Head bare on sides and beneath. Claws scarcely curved. Colors dark, metallic, greenish and chestnut.
Plegadis 252
Face without white feathers in adult . . . . . *falcinellus* 649
Face surrounded by white feathers in adult . . . . . *guarauna* 650
Head extensively bare on front, sides, and beneath. Claws curved. Colors light, dull, red or white.
Eudocimus 253
Adults white . . . . . *albus* 651
Adults scarlet . . . . . *ruber* 652

252. **PLE'GADIS.** (Gr. πληγάς, *plegas*, a scythe, sickle.) GLOSSY IBISES. Bill twice as long as head, or more, regularly decurved; both mandibles grooved on sides for their whole length; culmen prominent from near base for most of its length, flattened and grooved on terminal two-fifths; symphysis of lower mandible grooved to tip. Thus each mandible, toward the end of the bill, has 3 grooves, one median and two lateral; 6 in all. Nostrils linear, in advance of base of upper mandible, in its lateral grooves. Frontal feathers sweeping with strongly convex outline across forehead, near but not quite at base of bill; lores broadly naked, the bare space embracing eyes; a pointed projection of feathers on side of lower mandible; another median one advancing farther and more acutely on bare space of chin, which is thus forked behind. Tibiæ bare for a distance equal to half or more of the length of tarsus; mostly reticulate, but with smooth bare skin for a space above in front. Tarsus longer than middle toe and claw, reticulate, scutellate in front. Lateral toes unequal, the inner shortest. Hind toe somewhat elevated, without claw not half as long as middle toe without claw. Claws all long and slightly curved; inner edge of middle one dilated and cut three or four times, but without the regular "comb" of a heron's. Wings and tail ordinary, latter of 12 feathers. Colors dark glossy-green and chestnut; bill and feet dark. Two or three species, one cosmopolitan, one or two confined to America. Sexes alike; young different. Eggs whole-colored.

649. **P. falcinel'lus.** (Lat. *falcunculus* or *falcinellus*, a little scythe.) GLOSSY IBIS. ♂ ♀, adult: No white feathers around face. General color rich dark purplish-chestnut, opaque, changing on head, back, wings (excepting lesser coverts), and tail, to glossy dark purplish-green; sides and lining of wings and crissum dusky greenish; primaries greenish-black. Bill blackish; legs grayish-black; iris brown; bare skin of head slaty-blue. Young: Head, neck, and under parts grayish-brown, the two former streaked with whitish; upper parts glossy dusky-green. Length about 2 feet; extent about 3 feet; wing 10.00–11.00 inches; tail 4.00; bill 4.50–5.50; tibiæ bare about 2.50; tarsus 3.50; middle toe and claw rather less. This bird is chiefly Old World, not common or regular in America, found occasionally anywhere E. of the Mississippi, especially coastwise and southerly; N. casually to New England. The next species is much more abundant in its proper range. Eggs with shell rougher and heavier than that of heron's eggs, ovoidal, not elliptical, greenish-blue, 1.90 to 2.10 long, by about 1.48 broad.

650. **P. guarau'na.** (Vox barb., S. Am.) WHITE-FACED GLOSSY IBIS. Adult ♂: A white margin of feathers entirely surrounding the bare space on head. Head otherwise, neck, and entire under parts of the body, including the tibiæ, rich purplish-chestnut, quite uniform on the under parts, obscured with dusky on the head and nape, there iridescent with violet. Back and wings intensely iridescent with various metallic tints; back, wing-coverts, and inner quills shining with violet, green, and purple; scapulars more like under parts, being of a rich deep wine-red and less lustrous than the wing-coverts. Primaries green, with brassy or almost golden lustre. Rump, upper tail-coverts and tail chiefly green, but with various violet and purple reflections; lower tail-coverts similar, contrasting with the chestnut of the belly. Lining of wings brassy-green, like the primaries; axillars violet, like the upper wing-coverts. Bare facial area apparently reddish. Bill blackish, reddening toward end; legs and feet dusky-reddish; claws blackish; iris red. Length 22.00–24.00; extent 38.00–40.00; wing 10.00–11.00; tail 3.75–4.25; bill 5.00–5.50; tibiæ bare 2.50; tarsus 3.75; middle toe and claw 3.25; inner do., 2.50; outer do., 2.90; hind do., 1.60. ♀ similar, averaging smaller; length 21.50; extent 36.00, etc. In this beautiful species, the feathers sweep down on the forehead with regular convexity, nearly but not quite to the base of the culmen, thence retreating around back of the eye, which is wholly in bare skin, then running forward to a point on the side of the lower mandible; retreating again, then running forward in a point on the middle line of the chin, further than on jaw or forehead; there being thus enclosed, on each side of the head, a broad naked space, widest forward, narrowing behind to embrace the eye; and between the rami of the jaw another bare space, forked behind to receive the projecting feathers of the

chin, and not quite separated from the bare loral space, because the feathers on the side of the jaw stop a little short of the hard base of the mandible. Young, first plumage (with traces of down still) : Remarkably lustrous. Plumage entirely green : legs black ; bill blackish, irregularly blotched or regularly banded with pinkish-white. This green unicolor plumage, constituting *Ibis thalassinus* of some, is retained till full growth, gradually giving way through a

FIG. 454. — European Spoonbill, *Platalea leucorodia*, $\frac{1}{8}$ nat. size. (From Brehm.)

brownish or grayish to the purple-chestnut and iridescent plumage. Chicks hatch clothed in blackish down, with whitish bill. Southwestern U. S., especially Texas ; N. to Kansas ; W. through New Mexico and Arizona to California (to Oregon?), and far S. in tropical America. Swarming by thousands at some points along the Rio Grande. Nest in vast heronries with various herons, in the beds of reeds and rushes, rising in air by "hundreds of acres" when a gun is fired. Nest strongly and compactly woven of dead reeds, affixed by twining to broken down

or upright living ones, about a foot in diameter and nearly as deep, well cupped, thus unlike the frail platforms herons build. Eggs 3–4, rarely 5, deep bluish-green, not elliptical, from 1.72 × 1.30 to 2.20 × 1.50, averaging 1.99 × 1.42.

253. **EUDO'CIMUS.** (Gr. εὐδόκιμος, well-tried, approved, famous.) WHITE IBIS. SCARLET IBIS. General character of *Plegadis*. Face more denuded, with whole chin bare (in the adults). Claws stout, obtuse, curved. Plumage not metallic. Color white or red. Eggs spotted (in *E. albus* at least).

651. **E. al'bus.** (Lat. *albus*, white.) WHITE IBIS. SPANISH CURLEW. Adult ♂ ♀: Plumage pure white; tips of several outer primaries glossy black. Bare face and most of bill, and legs orange, red, or carmine; bill tipped with dusky. Iris pearly blue. Length about 26.00; extent 40.00; wing 11.50–12.50; tail 5.00; bill 5.00–7.00; tarsus 3.50; middle toe and claw 2.50. Sexes alike; ♀ averaging smaller. Young: Dull brown, rump and under parts white; bare parts of head of less extent, yellowish, bill the same; legs bluish; iris brown. Younger: Dull brown all over, with whitish rump and gray tail. S. Atlantic and Gulf States, N. to the Ohio, rarely to the Middle States, casually to New England; W. to Texas; resident in Florida. Breeds in communities by thousands in tangle and brake and tulé of the S. coast; nest similar to that above described, but of twigs, etc. Eggs 3, 2.25 × 1.60, dull chalky white, blotched and spotted with pale yellowish and dark reddish-brown.

652. **E. ru'ber.** (Lat. *ruber*, red.) SCARLET IBIS. Adult ♂ ♀: Plumage scarlet; tips of several outer primaries glossy black. Bare parts of head, bill, and legs pale lake red. Young brownish-gray, darker above, paler or whitish below. Size and proportions nearly as in the last. This splendid creature is a native of Tropical America: accidental in the U. S. (Seen at a distance, not procured, Louisiana, July, 1821, *Audubon;* fragment of a specimen examined, Los Pinos, N. M., on the Rio Grande, June, 1864, *Coues*; "Florida," specimen in Museum of Charleston College, S. C., *Brewster*.)

44. Family PLATALEIDÆ: Spoonbills.

Bill long, flat, remarkably widened, rounded, and spoon-shaped at the end. Birds of this group are known at a glance, by the singularity of the bill; they closely resemble the foregoing in structure and habit, being simply spoon-billed Ibises. Two genera, with five or six species of various countries. The American genus differs notably from the type of *Platalea*, in having the trachea simple, bifurcating into the bronchi high in the neck; the bronchi with fusiform partly membranous dilatation before entering the thorax. In *Platalea leucorodia* (fig. 454) the trachea is peculiarly convoluted within the thorax.

254. **Aja'ja.** (Vox barb., S. Am.) AMERICAN SPOONBILLS. Character as above said. In addition: Head entirely bald, in the adult. Throat somewhat pouched. Nostrils basal, linear-oblong. Tibiæ and tarsi reticulate with hexagonal plates. Toes semipalmate; hind toe well down. Tail of 12 feathers. Bill broader than head at the greatest width of the spoon. A lateral groove the whole length of the upper mandible. A nail at end of bill; much of bill rugous and skinny. A recurved tuft of feathers on the foreneck below. Colors white and red. Sexes alike; young different. One species.

653. **A. ro'sea.** (Lat. *rosea*, roseate.) ROSEATE SPOONBILL. Adult ♂ ♀: Ground color white; back and wings delicate rose-color; under parts more rosy; plumes of the lower fore-neck, lesser wing-coverts, upper and under tail-coverts, rich carmine: shafts of wing- and tail-feathers carmine. Tail brownish-yellow, and a patch of the same color on the sides of the breast; neck white. Bald head varied with green, yellow, orange, and black; bill varied with greenish, bluish, yellowish, and blackish tints. Legs lake red. Iris carmine. Claws blackish. Length 31.00–35.00; extent 50.00–55.00; wing 15.00–16.00; tail 4.00–5.00; bill 7.00, 2 inches or more across the spoon; tibia bare 3.00; tarsus 4.00; middle toe and claw 3.50; hind do.

2.00. ♀ similar, smaller; length 30.00 or less; extent 48.00. Young: Head mostly feathered, and general color grayish-white; acquire white with rosy the second year; full plumage the third. Weight of adults 3 or 4 lbs. This bird, so singular in form and magnificent in color, inhabits the South Atlantic and Gulf States, and southward in Tropical America; resident in Florida; N. only to the Carolinas. Breeds in communities in trees and bushes of tangled swamps. Nest a platform of sticks like a heron's; eggs usually 3, laid in April, nearly elliptical, 2.60 × 1.90, white.

13. Suborder PELARGI: The Stork Series.

Skull holorhinal. Angle of mandible truncate. Ambiens muscle and accessory femoro-caudal absent; femoro-caudal present or absent; semitendinosus and its accessory present; pectoralis major double; biceps cubiti and tensor patagii longus disconnected. Carotids double, normal. Two intestinal cœca. A tufted oil-gland. Plumage without powder-down; feathered tracts broad. Tarsi normally reticulate. Hallux not fairly insistent. Claws resting upon a horny "shoe." Inner edge of middle claw not pectinate. Side of upper mandible ungrooved, without nasal fossa, the nostrils bored directly in its substance; bill very stout, compressed, tapering, straight or recurved or decurved.

The Storks belong chiefly to the Old World, the warm and temperate portions of which they inhabit. There are about a dozen species, representing nearly as many genera of authors; among these *Anastomus* and *Hiator* are remarkable for a wide interval between the cutting edges of the bill, which only come into apposition at the base and tip. The singular African *Scopus umbretta*, type of a family, is often placed among the Herons, but its pterylosis is that of Storks.

45. Family CICONIIDÆ: Storks.

Bill longer than head, very stout at base, not grooved, tapering to the straight, recurved or decurved tip. Nostrils pierced directly in the horny substance, without nasal scale or membrane, high up in the bill close to its base. Legs reticulate. Hallux not or not completely insistent. Claws not acute.

The family falls in two American subfamilies, that of the Storks proper, and that of the so-called "Wood Ibises." Both are represented in N. America.

Fig. 455. — Wood Ibis, greatly reduced. (From Tenney, after Audubon.)

58. Subfamily TANTALINÆ: Wood Ibises.

Bill long, extremely stout at base, where it is as broad as the face, gradually tapering to the *decurved* tip, without nasal groove or membrane, the nostrils directly perforating its substance, high up at base of upper mandible. Toes lengthened, the middle not less than half as long as the tarsus, the outer longer than the inner; hind toe nearly insistent; claws less nail-like than in *Ciconiinæ*. One American genus and species, and one genus with 3 or 4 species of Africa, Southern Asia, and part of the East Indies. As these birds have been ascertained to be Storks, it is unfortunate that the name of "Ibis," tending to promote confusion, should be too firmly attached to them to leave any hope of its being abolished from such connection.

Just as we saw the American Spoonbill distinguished from *Platalea* of the Old World, so does the American Wood Ibis differ from Old World *Tantalus* to a marked degree in the structure of the windpipe; but this time it is our bird which has that organ simple, it being remarkably complicated in the other. In *Tantalus ibis*, typical of the genus, the trachea is several times folded and doubled upon itself in the thorax. In *Tantalus loculator*, the trachea is short, straight, and simple in its lower part, with numerous reduced and modified rings, and flattened from side to side, producing a ridge in front. It has been made type of a genus *Tantalides*, but that name being preoccupied, a new one seems to be required.

255. **TAN'TALOPS.** (Gr. Τάνταλος, Lat. *Tantalus*, a mythical character; ὤψ, *ops*, aspect.) American Wood Stork or Wood "Ibis." Character as above. In addition: Whole head and part of the neck bare, rugous and scaly in the adult. Nasal fossæ not continued beyond the nostrils. Anterior toes webbed at base. Tibiæ bare for half their length. Claws compressed, but obtuse. Head feathered in the young. Sexes alike. Color white and black.

648. **T. locula'tor.** (Lat. *locus*, a place; *loculus*, a little place, but qu. *loculator* in its application to this bird? Fig. 455.) American Wood Stork. Wood Ibis. Colorado Turkey. Adult ♂ ♀: Plumage white, the wing-quills, primary coverts, alula, and tail, glossy black. The bald head livid bluish and yellowish. Bill dingy yellowish. Legs blue, becoming blackish on the toes, the webs tinged with yellow. Iris dark brown. Length nearly 4 feet; extent 5.50 feet; wing 1.50; tail 0.50; bill 9 inches, 2 or more deep at base: tibiæ bare 6.00; tarsus 8.00; middle toe and claw 4.75. Weight 10 or 12 lbs. ♀ smaller than ♂. Young: Head downy-feathered; the plumage dark gray, with blackish wings and tail; plumage whitening and head becoming bald after the first month. South Atlantic and Gulf States, and across in corresponding latitudes to the Colorado River, where abundant. N. to the Carolinas; up the Mississippi to the Ohio; casually straying to Penn., N.Y., and even New England (?).[1] W. I., Mex., C. and S. Am. Resident in the S. States; abundant; gregarious; frequents the most thickly wooded swamps and bayous, fairly swarming in its heronries; flight performed with alternate flapping and sailing; at times mounts high in air and performs the most beautiful evolutions, with motionless wings, like a turkey buzzard. Eggs 2–3, elliptical in contour, shell rough with flaky substance; color white; size 2.75 × 1.75.

59. Subfamily CICONIINÆ: True Storks.

Bill as above described, but end not decurved (straight or *re*curved). Nostrils nearly lateral. Toes short, the middle less than half the tarsus. Lateral toes nearly equal. Hind toe not insistent. Claws short, broad, obtuse, flattened like nails. Several Old World and two American genera, *Dissoura (D. maguari)* and *Mycteria.*

256. **MYCTE'RIA.** (Gr. μυκτήρ, *mukter*, the snout; μυκτηρίζω, *mukterizo*, I turn up the nose.) Jabirus. Bill immensely large, recurved. Whole head and neck bare, except a hairy patch on the occiput. Tail not peculiar. (In *Dissoura*, bill moderate, straight, head mostly feathered, tail forked, and its under coverts stiffened and lengthened, resembling rectrices.)

654. **M. america'na.** American Jabiru. Adult: Plumage entirely white. Bill, legs, and feet, and bare skin of head and neck, black, the neck with a broad bright red collar round the lower portion. Immature (transition plumage): Rump, upper tail-coverts and tail, white; rest of upper parts, including feathered portion of lower neck, soft light brownish-gray, irregularly mixed, except on lower neck, with white feathers of the adult livery; lower parts entirely white. Bill, etc., colored as in the adult. Wing 24.50–26.00; tail 9.50; culmen 9.75–12.30; depth of bill through base about 2.50; tarsus 11.25–11.50; middle toe 4.20–4.50. Tropical America, N. to Texas.

[1] Mr. Allen informs me that the alleged New England case is doubtless erroneous (Bull. Nuttall Club, viii, July, 1883, p. 187).

14. Suborder HERODII: The Heron Series.

Skull holorhinal. Angle of mandible truncate. Ambiens muscle, and accessory femoro-caudal, absent; femoro-caudal, semitendinous and its accessory, present. Carotids double, sometimes abnormal (p. 198). One intestinal cœcum. Tongue moderate. A tufted oil-gland. Plumage with 2–4 pairs of powder-down tracts; feathered tracts very narrow. Tarsi normally scutellate. Hallux long and perfectly insistent, with long claw. Inner edge of middle claw distinctly pectinate. Bill variable with the families, normally narrow and wedged, with long nasal fossæ.

The extraordinary *Balæniceps rex*, the Shoe-bill or Whale-head, of Africa, with an enormous head and bill, thick neck, and one pair of powder-down tracts, is the type of a family *Balænicipitidæ*, which may belong here; but it approaches the Storks, and its peculiarities are so great that it may constitute a separate superfamily group. The Boat-billed Heron (*Cancroma cochlearia*) of Central America, with a singular shape of bill that has suggested the name, and four pairs of powder-down tracts, constitutes one family of *Herodii* (*Cancromidæ*). The disputed cases of *Eurypyga* and *Scopus* have already been mentioned. These and some other doubtful forms aside, the Heron series is represented by the single

46. Family ARDEIDÆ: Herons.

It is in this family, as in *Cancromidæ*, that powder-down tracts reach their highest development; and although these peculiar feathers occur in some other birds, there appears to be then only a single pair; so that the presence of two or three pairs is probably diagnostic of this family. In the genus *Ardea* and its immediate allies (*Ardeinæ*) there are three pairs, the normal number; one on the lower back over the hips, one on the lower belly under the hips, and one on the breast, along the track of the furcula. In the Bitterns (*Botaurinæ*) the second of these is wanting. (In the Boat-billed Heron, *Cancroma cochlearia*, there is still another pair, over the shoulder-blades.) There are other pterylographic characters; in general, the tracks are extremely narrow, often only two feathers wide; there are lateral neck tracks; the lower neck is frequently bare behind. More obvious characters are, the complete feathering of the head (as compared with Storks, etc.) except definite nakedness of the lores alone — the bill appearing to run directly into the eyes; a general looseness of the plumage (as compared with *Limicolæ*), and especially the frequent development of remarkably lengthened, or otherwise modified, feathers, constituting the beautiful crests and dorsal plumes that ornament many species, but which, as a rule, are worn only during the breeding season. These features will suffice to determine the *Ardeidæ*, taken in connection with the more general ones indicated under head of *Herodiones*, and the following details: —

Bill longer than head, usually about as long as tarsus, straight, or very nearly so, more or less compressed, acute, cultrate (with sharp cutting edges); upper mandible with a long groove. Nostrils more or less linear, pervious. Head narrow and elongate, sloping down to the bill, its sides flattened. Lores naked; rest of head feathered, the frontal feathers extending in a rounded outline on the base of the culmen, generally to the nostrils. Wings broad and ample; the inner quills usually as long as the primaries, folding over them when the wing is closed. Tail very short, of twelve (usually) or ten (in *Zebrilus* and *Botaurinæ*) soft broad feathers. Tibiæ naked below (except *Zebrillus*), sometimes for a great distance. Tarsi scutellate in front (except *Tigrisoma*), and sometimes behind, generally reticulate there and on the sides. Toes long and slender; the outer usually connected with the middle by a basal web, the hinder very long (for wading birds), inserted on the level of the rest. Hind claw larger and more curved than the middle one (always?); the middle claw *pectinate*.

The group thus defined offers little variation in form; all the numerous genera now

in vogue have been successively detached from *Ardea*, the typical one, with which many of them should be reunited. The "Night Herons" (*Nyctiardea* and *Nycterodius*) differ some-

FIG. 456. — Herons, idealized from *Ardea cinerea*. (From Michelet.)

what in shortness and especially stoutness of bill; while the Bitterns (*Botaurus* and *Ardetta*), the South American genera *Tigrisoma*, *Zebrilus*, and a few others, are still better marked.

There are about seventy-five species, very generally distributed over the globe, but especially abounding in the torrid and temperate zones. Those that penetrate to cold countries in summer are regular migrants; the others are generally stationary. They are maritime, lacustrine and paludicole birds, drawing their chief sustenance from animal substances taken from the water, or from soft ground in its vicinity; such as fish, reptiles, testaceans, and insects, captured by a quick thrust of the spear-like bill, given as the bird stands in wait or wades stealthily along. In conformity with this, the gullet is capacious, but without special dilatation, the stomach is small and little muscular, the intestines are long and extremely slender, with a large globular cloaca and a cœcum. Herons are altricial, and generally nest in trees or bushes (where their insessorial feet enable them to perch with ease), in swampy or other places near the water, often in large communities, building a large flat rude structure of sticks. The eggs vary in number, coincidently, to some extent, with the *size* of the species; the larger herons generally lay two or three, the smaller kinds five or six; the eggs are somewhat elliptical in shape, and usually of an unvariegated bluish or greenish shade. The voice is a rough croak. The sexes are nearly always alike in color (remarkable exception in *Ardetta*); but the species in which, as in the Bittern, the plumage is nearly unchangeable, are very few. Indeed, probably no birds show greater changes of plumage, with age and season, than nearly all the herons. Their beautiful plumes are only worn during the breeding season; the young invariably lack them. There are still more remarkable differences of plumage in many cases, constituting *dichromatism*, or permanent normal difference in color, like that of the "red" and "gray" specimens of *Scops* Owl. Thus, some species are pure white at all ages and seasons, in both sexes, other individuals of the same species being variously colored. Such dichromatism appears in our *Ardea occidentalis*, *Dichromanassa rufa*, and *Florida cœrulea*. It was formerly believed in the cases of the two latter, that the white were the *young*, the colored the adults; but it now appears that the difference is permanent, and independent of age, sex, or season. Many species are pure white at all times, and to these the name of "egret" more particularly belongs; but I should correct a prevalent impression that an egret is anything particularly different from other herons. The name, a corruption of the French word "aigrette," simply refers to the plumes that ornament most of the herons, white or otherwise, and has no classificatory meaning; its application, in any given instance, is purely conventional. The colors of the bill, lores, and feet are extremely variable, not only with age or season, but as individual peculiarities; sometimes the two legs of the same specimen are not colored exactly alike. The ♀ is commonly smaller than the ♂. The normal individual variability in stature and relative length of parts is very great; and it has even been noted that a specimen may have one leg larger than the other, and the toes of one foot longer than those of the other — a circumstance perhaps resulting from the common habit of these birds of standing for a long time on one leg.

The North American *Ardeidæ*, if not the whole family, are divisible into the two subfamilies of *Ardeinæ*, or *Herons proper*, and *Botaurinæ*, or *Bitterns*.

Analysis of Subfamilies, Genera, and Subgenera.

BOTAURINÆ. Tail-feathers 10. Two pairs of powder-down tracts. (Bitterns.)
- Very small; length about a foot. Sexes unlike . . . . . *Ardetta* 267
- Medium sized; length about 2 feet. Sexes alike . . . . . *Botaurus* 266

ARDEINÆ. Tail-feathers 12 Three pairs of powder-down tracts. (Herons.)
- Bill stout and comparatively short, not longer than very short tarsus, which is not perfectly scutellate in front. (Night Herons.)
  - Gonys convex, like the culmen; tarsus longer than middle toe and claw . . . . . *Nycterodius* 265
  - Gonys about straight; tarsus about equal to middle toe and claw . . . . . *Nyctiardea* 264
- Bill ordinary. Tarsus scutellate in front
  - Length under 20 inches. Tarsus about equal to middle toe and claw. Green . . . . *Butorides* 263
  - Length over 20 inches, under 30. Blue, white, or variegated.
    - Blue or white. Adult without decomposed feathers on back . . . . . *Florida* 262

Always white. Adult with decomposed recurved feathers on back . . . . . *Garzetta* 259
Ashy-blue, white below. Bill longer than tarsus . . . . . *Hydranassa* 260
Length 30, not 36 inches. Blue or white. Tarsus twice as long as middle toe. Bill shorter than tarsus . . . . . *Dichromanassa* 261
Length 36 or more. Entirely white; no crest; long decomposed feathers on back . . *Herodias* 258
Length 42 or more; of dark varied colors, or white; crested, without dorsal plumes . . *Ardea* 257

60. Subfamily ARDEINÆ: True Herons.

Tail-feathers 12 (in all N. Am. genera), broad and stiffish. Powder-down tracts 3 pairs. Tibiæ naked below. Outer toe not shorter than inner. Claws moderate, curved. (Embracing most of the species of the family, and all our species excepting the Bitterns.)

257. AR'DEA. (Lat. *ardea*, a heron.) GREAT HERONS. Of largest size. Neck and legs very long, former well feathered all around. Tibiæ extensively denuded below. Tarsus longer than middle toe and claw. Outer lateral toe longer than inner. Bill shorter than tarsus, equal to or longer than middle toe and claw. Colors dark and varied, exceptionally white; back without lengthened loosened plumes; scapulars lanceolate, lengthened, but not loosened; lower fore-neck with lengthened feathers; head crested, in breeding season with two long, slender, flowing, occipital plumes. Sexes alike; young similar, but lacking all lengthened feathers. Dichromatic. (Genera 258–263 should be reduced to subgenera of *Ardea*.)

FIG. 457. — Great Blue Heron, greatly reduced. (From Tenney, after Audubon.

Analysis of Species.

Tibiæ and edge of wing white; occiput and plumes black. (Europe.) . . . . . *cinerea* 657
Tibiæ and edge of wing rufous; or whole plumage white.
Occiput and plumes black; whole plumage varied. Bill 6 or less; tarsus 8 or less . . . . *herodias* 655
Occiput and plumes white; or, whole plumage white. Bill 6 or more; tarsus 8 or more *occidentalis* 656

655. A. hero'dias. (Lat. *herodias*, a proper name; Gr. *ἐρώδιας*, *erodias*, a heron. Fig. 457.) GREAT BLUE HERON. Of large size, and varied dark colors; not dichromatic. Back without peculiar plumes at any season, but scapulars lengthened and lanceolate; an occipital crest, two de-

ciduous feathers of which in the breeding season are long and filamentous; long loose feathers on the lower neck. Length 42.00–50.00; extent about 70.00; wing 18.00–20.00; tail 7.00–8.00; bill 4.50–6.25, usually between 5.00 and 6.00; tibiæ bare 3.00–4.00; tarsus 6.00–8.00, usually 6.50–7.00; middle toe and claw about 5.00. ♀ average smaller than ♂. Weight 6 or 8 lbs. Adult ♂ ♀, in breeding dress: Bill yellow, more or less blackened on culmen; lores blue; iris chrome-yellow; legs and feet blackish, the soles yellowish. Tibia and edge of wing chestnut-brown. Forehead and middle of crown white; sides of crown and occipital crest black. Neck pale purplish-gray, with a mixed white, black, and rusty throat-line, yielding to white on chin and cheeks. Plumes of lower neck, the breast, and belly, black, more or less interrupted with white streaks on the middle line; crissum white. Upper parts in general slaty-blue; tail the same; long scapular feathers more pearly-gray; wing-quills deepening from this color to the black primaries. Young: Without any long feathers. Crown and front without white; whole top of head blackish. Tibiæ and edge of wing paler rufous, or whitish. General color of upper parts paler and more grayish-blue, more or less tinged with rusty. Black of under parts replaced by ashy. Upper mandible mostly blackish; lores and most of lower mandible greenish, rest of the latter and the eyes, yellow; tibiæ greenish. There are endless variations in plumage and colors of the soft parts, but this great species cannot be mistaken, being only closely related to the colored phase of the next. N. Am. at large, and much of C. and S. Am., N. to Labrador, Hudson's Bay, and Sitka in Alaska; northerly migratory; elsewhere resident. Breeds in suitable places throughout its range, sometimes singly, oftener in great heronries to which the birds resort year after year, shared usually with other species of its tribe. Nest usually in trees or bushes, in the West sometimes on cliffs; eggs 3–6, oftener 3–4, pale dull greenish-blue, ellipsoidal, about 2.50-1.50.

656. **A. occidenta'lis.** (Lat. *occidentalis*, western.) FLORIDA HERON. GREAT WHITE HERON. WÜRDEMANN'S HERON. Similar to the last; larger; dichromatic. Length 54.00; extent 83.00; wing 19.00–21.00; tail 8.00; bill 6.50; tarsus 8.00–8.50; tibiæ bare 5.50. ♂ ♀, adult, colored phase (*wurdemanni* Bd.): Head, with the crest, white, the forehead streaked with black edges of the feathers. Under parts white, the sides streaked with black; lower plumes of neck white, mostly streaked with black edges of the feathers. Neck purplish-gray, darker than in *A. herodias*, with a similar throat-line of white, black, and rufous. Under wing-coverts streaked with white; rufous of edge of wing less extensive than in *A. herodias*, that of the tibiæ paler. Tibiæ and soles of feet yellow; tarsi and top of toes yellowish-green. Young: Like young *herodias;* top of head dusky, the feathers with whitish shaft-lines and bases. Lesser wing-coverts speckled with rusty, the under ones with white. Adult ♂ ♀ in white phase (*occidentalis* Aud.): Color entirely pure white; bill and eyes yellow; culmen greenish at base; lores bluish; legs yellow, greenish in front. Southern Florida; Cuba; Jamaica; "S. Illinois and Indiana." Eggs 3, 2.75 × 1.67.

OBS. — **A. wardi** is described as indistinguishable in its white phase from the last; in its colored phase exactly like the last, but head colored as in *herodias;* bill 6.50–7.00; tarsus 8.50–9.00. Florida. (Bull. Nutt. Club, vii, Jan. 1882, p. 5.)

657. **A. cine'rea.** (Lat. *cinerea*, ashy. Fig. 456.) EUROPEAN BLUE HERON. Character similar to that of *A. herodias;* easily distinguished by the white (not chestnut) tibiæ and border of wings, and ashy neck. Europe; only N. American as a straggler to Greenland.

258. **HERO'DIAS.** (Lat. *herodias;* see above, No. 655. Fig. 458.) GREAT EGRET HERONS. Character of *Ardea* proper, excepting in plumage; color white; no crest; a long depending train of stiff-shafted loose-webbed scapular feathers in the breeding season. Size large, only exceeded by the species of *Ardea*. (See fig. of the European species, *H. alba*.)

658. **H. egret'ta.** (O. H. G. *hiegro*, a heron; Fr. *aigrette*, a plume; Engl. *egret*.) GREAT WHITE EGRET. WHITE HERON. No obviously lengthened feathers on the head at any time; in the breeding season, back with a magnificent train of very long plumes of decomposed, fas-

tigiate feathers drooping far beyond the tail; neck closely feathered. Plumage entirely white at all seasons. Bill, lores, and eyes, yellow; legs and feet black. Length 36.00–42.00 (not including the dorsal train, which is a foot or more longer); extent 55.00; wing 16.00–17.00; tail 5.50–6.50; bill 4.50–5.00; tarsus about 6.00; tibiæ bare 3.50. ♀ averaging smaller than ♂. U. S. southerly, and much of W. I., C. and S. Am.; straggling northward to Nova Scotia,

FIG. 458. — European Great White Egret, *Herodias alba*, ⅛ nat. size. (From Brehm.)

Canada, Minnesota, etc.; resident in the south. Breeds like other herons; eggs 3–4, 2.20–1.55.

259. **GARZET'TA**. (Ital. name of a heron. Fig. 459.) SMALL EGRET HERONS. Form of the preceding, but size small; length about 2 feet. Color white; an occipital crest, and short recurved train of stiff-shafted loose-webbed feathers in the breeding season; lower neck-feathers lengthened, depending. (See fig. of the European species, *G. nivea*.)

659. G. candidis'sima. (Lat. *candidissima*, very white; *candida*, white.) LITTLE WHITE EGRET. SNOWY HERON. Adults with a long occipital crest of decomposed feathers, and similar dorsal plumes, latter *recurved* when perfect; similar, but not recurved plumes on the lower neck, which is bare behind. Lores, eyes, and toes yellow; bill and legs black, former yellow at base, latter yellow at the lower part behind. Plumage always entirely white. Length about 24.00; extent 36.00–40.00; wing 9.50–11.00; tail 4.00; bill 3.00 or more;

FIG. 459. — European Little White Egret, *Garzetta nivea*, ¼ nat. size. (From Brehm.)

tibiæ bare 2.50; tarsus 3.75; middle toe 2.75. S. States; Cala.; Middle States, in summer; N. occasionally to New England, Canada, and Nova Scotia. Abundant in its regular range; resident in the South and beyond; breeds throughout. Eggs about 4, 1.67 × 1.25.

260. **HYDRANAS'SA.** (Gr. ὕδωρ, *hudor*, water, giving in Lat. *hydr-*; ἄνασσα, *anassa*, a queen.) DEMOISELLE EGRETS. Of medium size: length under two and a half or three feet. Bill very slender, contracted from the base toward the middle, with almost a little concave upper and under outline, then tapering to a point; in length equalling or exceeding the tarsus.

Toes comparatively short, the middle little more than half the tarsus. Adult with feathers of the head and neck lengthened, lanceolate, with well-defined edges; an occipital crest of several long plumes, and splendid dorsal train of decomposed, fringe-like feathers depending beyond the tail. Dichromatism not known.

660. **H. tri'color.** (Lat. *tricolor*, three-colored.) LOUISIANA EGRET. "LADY OF THE WATERS." Adult: Slaty-blue on the back and wings, mostly white below and along the throat-line; crest and most of the neck reddish-purple, mixed below with slaty; the longer narrow feathers of the crest white; lower back and rump white, but concealed by the dull purplish-brown feathers of the train, which whiten towards the end. Bill black and yellow; lores yellow; legs yellowish-green, dusky in front. Iris red. Young variously different, but never white; lacking the long occipital plumes and dorsal train; neck and back bright brownish-red; rump, throat-line and under parts white; quills and tail pale purplish-blue; legs dusky-greenish. Length 24.00–27.00 (exclusive of the long train); extent 37.00–39.00; wing 10.00–11.00; tail 3.50; bill 4.00–5.00; tibiæ bare 2.25; tarsus 4.00; middle toe and claw 3.00. S. Atlantic and Gulf States, chiefly maritime, very rarely N. to the Middle districts; S. in tropical Am. Resident along our southern coasts. Breeds in communities like other herons. Nest and eggs scarcely distinguishable from those of the snowy heron; eggs rather less elliptical, usually 4 in number, averaging 1.78 × 1.30.

261. **DICHROMANAS'SA.** (Gr. *δίς dis*, twice; *χρῶμα, chroma*, color; and *ἄνασσα*; alluding to the dichromatism of *D. rufa*.) DICHROIC EGRETS. Of medium size; length about two and a half feet. Bill slender, much as in the last, but shorter than the very long tarsus, which is about twice as long as the middle toe and claw. Toes extremely short (for this family). Feathers of head and neck elongate, lance-linear and stiffish, distinct; the longest forming occipital and jugular tufts. A dorsal train of long decomposed fastigiate feathers, with stiffened shafts. Dichromatic; pure white or colored; in latter state, without the white throat-line of most herons.

661. **D. ru'fa.** (Lat. *rufa*, reddish.) REDDISH EGRET. PEALE'S EGRET. In the colored phase: Adult grayish-blue, rather paler below; no white throat-line; head and neck lilac-brown; ends of the train yellowish. Bill black on the terminal third, the rest flesh-colored, like the lores; iris white; legs blue, the scales of the tarsus blackish. In the white phase: Plumage entirely pure white. Bill, lores, and eyes as before; legs dark greenish, the soles yellowish; in which state the bird is "Peale's Egret," long held for a distinct species, then long decided to be the young. Length 28.00–31.00; extent about 46.00; wing 12.50–14.50; tail 4.50; bill 4.00; tibiæ bare 4.00; tarsus 5.50–6.00; middle toe and claw 3.00. Gulf States strictly; maritime; resident, abundant. Nests in communities, with other species, upon low bushes, sometimes on the ground; eggs 3–4, of usual shape and color, from 1.90 × 1.48 to 2.12 × 1.55, averaging 2.00 × 1.50.

262. **FLO'RIDA.** (Named for the State.) BLUE AND WHITE HERONS. Of small size; length about 2 feet. Bill slender, very acute; culmen gently curved from near base; under outline straight or slightly concave; about as long as tarsus. Head of adult with lengthened decomposed feathers; those of lower neck, and the scapulars, lengthened and linear-lanceolate, but compact-webbed; no dorsal train of fringed feathers. Neck bare behind below. Dichromatic; color blue or white, or both.

662. **F. cœru'lea.** (Lat. *cærulea*, blue.) LITTLE BLUE HERON. LITTLE WHITE HERON (not to be confused with Little White Egret). In the colored phase: Slaty-blue, or dark grayish-blue, becoming purplish-red or maroon-colored on the neck and head. Bill and loral space blue, shading to black toward the end; legs and feet black; eyes yellow. Length about 24.00; extent 40.00–42.00; wing about 11.50; tail 4.25; bill 3.00–3.40; tarsus about the same, rather more; tibiæ bare 2.00. In one phase, entirely white; but generally showing traces of blue. Pure white birds require a second glance to distinguish them from immature

Garzetta candidissima, as they are of the same size, and not strikingly different in form; notice lores and basal half of bill greenish-blue, the rest blackish; most of lower mandible yellowish; legs greenish-blue, with yellow traces, or bluish-black; the snowy heron has no *bluishness* about the soft parts. S. Atlantic and Gulf States, resident, abundant; N. in summer often to the Middle States, casually to New England. Nesting as usual; eggs 3–4, 1.75 × 1.25, of usual shape and color.

263. **BUTORI'DES**. (Lat. *butor*, a bittern; Gr. *εἶδος*, *eidos*, resemblance.) GREEN HERONS. Size small; length one and a half feet. Bill moderate, longer than tarsus, with gently convex culmen and gonys. Legs short; tibiæ little denuded; tarsus scarcely or not longer than middle toe and claw. An occipital crest of lengthened, lanceolate, not decomposed, feathers; neck-feathers long but blended, those below depending in a tuft, those on sides hiding an extensive bare space behind. In the breeding season, feathers of back lengthened, lance-linear, but compact-webbed, and not forming a train. Upper parts glossy green.

663. **B. vires'cens.** (Lat. *virescens*, growing green.) GREEN HERON. Adult in the breeding season with the crown, long soft occipital crest, and lengthened narrow feathers of the back lustrous dark green, sometimes with a bronzy iridescence; the dorsal plumes in high plumage with a glaucous bluish cast. Wing-coverts green, with conspicuous tawny edgings; neck rich dark purplish-chestnut, the throat-line variegated with dusky and white. Under parts mostly dark brownish-ash; belly variegated with white. Quills and tail greenish-dusky with a glaucous shade; edge of the wing white; some of the quills usually white-tipped. Bill greenish-black, much of the under mandible yellow; lores and iris yellow; legs greenish-yellow; lower neck with lengthened feathers in front, a bare space behind. Young: Head less crested; back without long narrow plumes, but glossy-greenish; neck merely reddish-brown; whole under parts white, variegated with tawny and dark brown. Length 16.00–18.00; extent about 25.00; wing 6.50–7.50; bill 2.50; tarsus 2.00; middle toe and claw about the same; tibiæ bare 1.00 or less. U. S., and a little beyond, abundant in summer; resident in the South, and beyond. This is a very pretty and engaging little heron, in spite of the ridiculous nickname by which it is so well known to the great unwashed democracy of America. Breeds anywhere in its range, sometimes in communities with larger species, often by itself in pairs. Nest a rude platform of twigs, on tree or bush; eggs 3–6, elliptical, 1.37 × 1.12, pale greenish.

264. **NYCTIAR'DEA.** (Gr. *νύξ*, gen. *νυκτός*, *nux*, *nuktos*, night: Lat. *ardea*, a heron. Fig. 460.) NIGHT HERONS. Of medium size; length about 2 feet. Bill very stout for this family; bill, tarsus, and middle toe with claw, of approximately equal lengths. Tarsus reticulate in front below. Tibiæ briefly naked below. Neck short, corresponding to the short legs; body stout. No peculiar plumes, excepting two or three extremely long filamentous feathers springing from the hind head, generally imbricated in one bundle. Sexes alike; young very different. A better genus than any of the foregoing, as distinguished from *Ardea*, but very near the next, which might be combined with it.

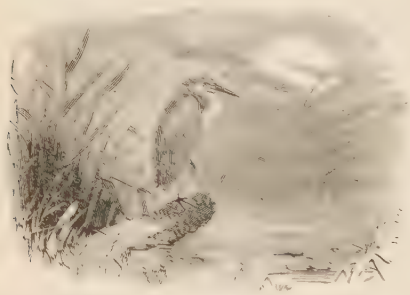


FIG. 460. — Night Heron. (From Lewis.)

664. **N. gri'sea næ'via.** BLACK-CROWNED NIGHT HERON. QUA-BIRD. SQUAWK. Adult ♂ ♀: Crown, scapulars and interscapulars very dark glossy green; other upper parts, wings and tail, pale bluish-gray with a lilac or lavender tinge, most decided on the neck. Forehead and throat-line white, shading into the lilaceous of the neck; under parts whitish, tinged with lilac. The long occipital plumes white. Eyes red; lores greenish; bill black; legs yellow; claws brown. Length 23.00–26.00; extent about 44.00; wing 12.00–14.00; tail 5.00; bill, tarsus, middle toe with claw, each 3.00 or a little more; tibiæ bare about an

inch. Young very different; grayish-brown above, the feathers with paler edges, and conspicuously spotted with whitish; the lower parts paler or dull whitish, streaky with darker; green of head replaced by chocolate-brown; quills chocolate-brown, white-tipped; no occipital plumes. U. S. and British Provinces, common; migratory; resident in the south. Breeds in heronries, sometimes of vast extent, resorted to year after year. Nest large and frail; eggs 3–4, of usual shape, very pale sea-green color, averaging 2.00 × 1.50. Our species is only a variety of the European *N. grisea*, whence the trinomial name; "*nævia*" is only applicable to the young in the spotted stage.

265. **NYCTERO'DIUS.** (Gr. *νύξ, νυκ*, night; *ἐρωδιός, erodios*, a heron.) THICK-BILL NIGHT HERONS. Of medium size; length about 2 feet. Bill extremely stout for this family; culmen curved throughout; gonys convex, ascending; commissure and lateral outlines of bill straight; bill much shorter than tarsus. Tarsus longer than middle toe and claw, reticulate excepting above in front. Feathers of occiput lengthened, the longest of great extent, and linear, forming a hanging crest; feathers of back lengthened and lanceolate, the longest loose-webbed, extending beyond the tail. Sexes alike; colors variegated; young very different.

665. **N. viola'ceus.** (Lat. *violaceus*, violet-colored: straining a point.) YELLOW-CROWNED NIGHT HERON. Adult ♂ ♀: General color grayish-plumbeous, or light grayish-blue, darker on the back, where the feathers have black centres and pale edges, and rather paler below. Head and upper neck behind black, with a cheek-patch, the crown, and most of the crest, white, more or less tinged with tawny. Quills and tail dusky plumbeous. Bill black; eyes orange; lores greenish; feet black and yellow. Length about 24.00; extent 44.00; wing 12.00; tail 5.00; bill scarcely 3.00, over 0.50 deep at base; tibiæ bare 2.00; tarsus 4.00; middle toe and claw 2.75. Young: Above, grayish-brown, with an olive shade, streaked and spotted with brownish-yellow; below, streaked with brown and whitish; sides of head and neck yellowish-brown, streaked with darker; top of head and neck above behind blackish, variegated with white. Bill blackish, with much of the lower mandible, and the lores, greenish-yellow; legs the same, obscured on front of tarsus; iris yellow. S. Atlantic and Gulf States, and southward, occasionally N. to the Middle States; not abundant, and chiefly confined to the coast. Resident in Florida. Nest as usual in trees and bushes, in communities; eggs 3, pale greenish-blue; 2.00 × 1.45.

61. Subfamily BOTAURINÆ: Bitterns.

Tail-feathers 10, broad and very soft. Powder-down tracts 2 pairs. Outer toe shorter than the inner. Claws long and little curved. The Bitterns form a well-marked section of

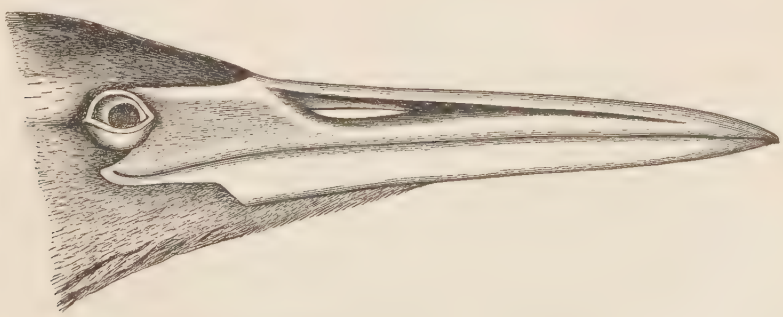


FIG. 461. — Bill of Bittern, nat. size. (Ad nat. del. E. C.)

the family, if not one of subfamily value. They are retiring and solitary birds of the marsh, not gregarious, not nesting in communities on trees, but by separate pairs, and on the ground; and the eggs have not the characteristic color of those of true Herons.

266. BOTAU'RUS. (Late Lat. *botaurus,* a bittern; said to be not equal to *bos-taurus;* from the hollow guttural cry?) BITTERNS. Of medium size; length about 2½ feet. Bill moderately longer than head, shorter than tarsus, which is shorter than middle toe and claw. Tarsus broadly scutellate in front. No crests or peculiar dorsal plumes; neck-feathers long and loose; plumage blended, spotty and streaky. Neck in part bare behind. Sexes and young alike.

666. B. mugi'tans. (Lat. *mugitans,* bellowing. Figs. 461, 462.) AMERICAN BITTERN. INDIAN HEN. STAKE-DRIVER. BOG-BULL. Plumage of the upper parts singularly freckled with brown of various shades, blackish, tawny, and whitish; neck and under parts ochrey or tawny-white, each feather marked with a brown dark-edged stripe, the throat-line white, with brown streaks. A velvety-black patch on each side of the neck above. Crown dull brown, with buff superciliary stripe. Tail brown. Quills greenish-black, with a glaucous shade, brown-tipped. Iris yellow. Bill on the ridge brownish-black, the rest pale yellowish; a dark brown loral stripe. Legs dull yellowish-green; claws brown. Length from 23.00 to 34.00 ! extent 32.00–45.00 ! wing 9.50–13.00; bill about 3.00; tarsus about 3.50; middle toe without claw about the same; its claw above an inch long. ♀ smaller than ♂; but few birds differ so much in size as this species, independently of sex. Entire temperate N. Am., N. to 58° or 60°, S. to C. Am.; accidental in Europe. Regularly migratory; resident in the South. The bittern is a bird of very marked character. It inhabits bog and brake, singly or in pairs; has a hoarse gurgling outcry of alarm, and a note sounding like the strokes of a mallet on a stake. Nests on the ground; eggs 3–5, brownish-drab with a gray (*not* green) shade, 1.90 to 2.00 long by about 1.50.

FIG. 462.—American Bittern. (From Tenney, after Audubon.)

267. ARDET'TA. (Ital. diminutive of *Ardea.*) DWARF BITTERNS. Very small, least of the whole family; length about a foot. In form very nearly as in *Botaurus.* Bill slender. Tarsus about equal to middle toe and claw. No peculiar feathers; those of lower neck long and loose; head slightly crested. Colors of back in large areas. Sexes dissimilar; young similar. There are several species of these queer little herons, of America and the Old World; they mostly inhabit reedy swamps, and somewhat approach rails.

667. A. exi'lis. (Lat. *exilis,* for *exigilis,* exiguous, slight, small.) LEAST BITTERN. Adult ♂ with the slightly crested crown, back, and tail, glossy greenish-black. Neck behind, most of the wing-coverts, and outer edges of inner quills, rich chestnut; other wing-coverts brownish-yellow. Front and sides of neck, and under parts, brownish-yellow, varied with white along the throat-line, the sides of the breast with a blackish-brown patch. Bill mostly pale yellow, the culmen blackish; lores light green; eyes and toes yellow; legs green, the hinder scales yellow. ♀ with the black of the back entirely, that of the crown mostly or wholly, replaced by rich purplish-chestnut; the edges of the scapulars forming a brownish-white stripe on either side. Length 11.00–14.00; extent somewhere about 18.00; wing 4.00–5.00; tail, bill, tarsus, middle toe and claw, each, 2.00 or less. U. S. and Brit. Provinces, common; migratory; resident in the South; breeds throughout its range. Found also in W. I. and C. Am. Inhabits reedy swamps and marshes, such as rails frequent; nest on ground or in bush or reed patch,

a mere platform of dead rushes. Eggs 3–5, elliptical, about 1.92 × 1.22, white, with faintest tinge of bluish.

IX. Order ALECTORIDES: Cranes, Rails, and their Allies

A portion of these birds, representing the *Crane* type, have a general resemblance to the foregoing, but are readily distinguished by the technical characters given beyond under the head of *Gruidæ*, and in essential respects accord with the rest, representing the *Rail* type. The latter are birds of medium and small size, with compressed body, and the head feathered. The neck and legs are not particularly lengthened, but as a rule the toes are remarkably long, enabling the birds to run lightly over the soft oozy ground and floating vegetation of the reedy swamps and marshes they inhabit. This length of the toes has given a name, *Macrodactyli*, to the group; their shy retiring habit of skulking among the rushes has caused them to be sometimes called *Latitores* (skulkers). Their nature is præcocial; the eggs are numerous, usually laid on the ground, in a rude nest. The nourishment is essentially the same as that of the *Limicolæ*, but it is simply picked up from the surface, not felt for in the mud, nor stamped out of the ground. The hallux is usually lengthened, and but little elevated, but may be short and well up, or even absent. The feet are conspicuously lobate in some forms, but never extensively palmate; the phalanges of the front toes diminish in length from first to penultimate. The lower part of the crus is bare of feathers. The wings are usually short, rounded, and concave, the tail is very short, few-feathered, often held cocked up, and wagged in time with a bobbing motion of the head that occurs with each step taken.

The *Alectorides* are schizognathous in palatal structure. The nasal bones are schizorhinal in the *Crane* type, holorhinal in that of the *Rails*. The angle of the mandible is truncate. The maxillo-palatines are not spongy, but thin and laminate. There are normally no basipterygoid processes. The sternum is typically long and narrow, and may be entire, or deeply notched; it is sometimes excavated to receive folds of the windpipe. There are two carotids; and two intestinal cœca are present. While the general pterylosis is not peculiar, the *Alectorides* normally lack the powder-down tracts so characteristic of Herons and their allies. As to the classificatory muscles of the thigh, all five are present nearly throughout the order; exceptionally the femoro-caudal or its accessory is wanting.

These normally præcocial and ptilopædic (with whatever exceptions) birds are more sharply distinguished from the perfectly altricial *Herodiones* than they are from the completely præcocial and ptilopædic *Limicolæ;* with which latter, in fact, the *Alectorides* are directly connected through the Bustards (*Otididæ*) and the Thick-knees (*Œdicnemidæ*) — the line between the two orders being probably to be drawn between these two families.

This country affords typical representatives of the two leading forms of the order, that of the Cranes, to which *Aramus* belongs, and of the Rails, Coots, and Gallinules, as given beyond. There are, however, a number of remarkable outliers that may be briefly mentioned, as follows: The large and important Old World family of the Bustards, *Otididæ*, has already been mentioned as the connecting link between *Alectorides* and *Limicolæ*. The Kagu, *Rhinochœtus jubatus* of New Caledonia, and the Carle, *Eurypyga helias* of Guiana, each the type and single representative of a family, are near the Cranes in principal osteological characters, although pterylographically they are more like Herons, both possessing powder-down tracts; and *Eurypyga*, in particular, resembles Herons in other respects. More closely allied to the Cranes are the Trumpeters, *Psophiidæ*, of one genus and few species of South America; with the Cariamas, *Cariamidæ*, of the same country, represented only by the *Cariama cristata* and the *Chunga burmeisteri*. The Horned Screamers, *Palamedeidæ*, of South America, consisting of three species, *Palamedea cornuta*, *Chauna chavaria*, and *C. derbiana*, seem to be nearer the Rails, and also to closely approach some water birds; one of them is by some considered the nearest living

ally of the mesozoic *Archæopteryx;* they should probably constitute an order apart. Some gigantic extinct birds belong in the neighborhood of the rails and coots. Apparently rail-like, but probably more truly plover-like birds are the Jaçanás, *Parridæ*, noted for the length of the toes, and especially of the claws; they have a sharp spur on the wing. There are less than 12 species, usually referred to several genera, of various parts of the world; one of them lately ascertained to occur in our country. Finally, the Sun-birds, *Heliornithidæ*, are a small but remarkable family of one or two genera and about four species of tropical America, Africa, and southern Asia. They have been classed, on account of their lobate feet and a certain general resemblance, with the grebes; but the feet are like those of coots, and their whole structure shows that they belong with the ralliform birds.

Waiving consideration of certain disputed forms, the *Alectorides* may be ranged in two series, suborders, or superfamilies, according as they are crane-like or rail-like.

15. Suborder GRUIFORMES: Cranes and their Allies.

Represented in N. Am. by two families, *Gruidæ* and *Aramidæ*.

47. Family GRUIDÆ: Cranes.

As already explained, Cranes are related to Rails in essential points of structure, though more resembling Herons in their general aspect. They are all large birds, some being of immense stature; the legs and neck are extremely long (the latter with about 17 vertebræ); the wings ample, but incised along posterior border, from shortness of the outer secondaries; the tail short, usually of 12 broad feathers. The head is generally, in part, naked and papillose or wattled in the adult, with a growth of hair-like feathers, or, in some cases, an upright tuft of curiously bushy plumes. The general plumage is compact, in striking contrast to that of Herons; but the inner wing-quills, in most cases, are enlarged and flowing. In some species, the sternum is enlarged and hollowed to receive a fold of the windpipe, as in Swans, and some of the Storks and Ibises (p. 202). Bill equalling or exceeding the head in length, straight, rather slender but strong, compressed, contracted opposite the nostrils, obtusely pointed; nasal fossæ short, broad, shallow; nostrils near the middle of the bill, large, broadly open and completely pervious: tibiæ naked for a great distance; tarsi scutellate in front; toes short, webbed at base: hallux very short, highly elevated; inner anterior claw large. About 15 species of various parts of the world; only 3 of them American. Most of them fall in the genus *Grus;* the elegant "demoiselle" cranes of the Old World, *Anthropoïdes* (or *Tetrapteryx*) *virgo* and *paradisæa*, and the African *Balearica* (or *Geranarchus*) *pavonina*, are the principal exceptions.

268. **GRUS**. (Lat. *grus*, fem., a crane.) Cranes. Of maximum size and length of neck and legs; color white or gray. Head without crest; more or less bare of feathers in adult, carunculate, with hair-like bristles; forehead low. Character of bill, legs, and wings, typically as above said. Tail short, 12-feathered. Tarsus broadly scutellate in front. Toes short, the middle about third as long as tarsus; inner rather exceeding outer, with enlarged claw. Inner wing-quills lengthened, curved, pendent beyond primaries when the wing is folded. Nest on the ground; eggs few.

Analysis of Species.

Adult white, with black primaries. Nakedness extending backward in a point on top and side of head . . . . . *americana* 668

Adults gray. Nakedness forked on top of head by a point of feathers, and not reaching on side below eye.

Smaller: wing under 20.00; bill 4.00 or less; tarsus 8.00 or less . . . . . *canadensis* 669

Larger: wing over 20.00; bill 5.00 or more; tarsus 9.00 or more . . . . . *pratensis* 670

668. **G. america'na**. White Crane. Whooping Crane. Adult with the bare part of the head extending in a point on the occiput above, on each side below the eyes, and very hairy. Bill very stout, gonys convex, ascending, that part of the under mandible as deep as the upper

opposite it. Adult plumage pure white, with black primaries, primary coverts and alula; bill dusky greenish; legs black; head carmine, the hair-like feathers blackish. Young with the head feathered; general plumage gray? varied with brown. Length about 50 inches; extent 90.00; wing 24.00; tail 9.00; tarsus 12.00; middle toe 5.00; bill 6.00. In the adult, the windpipe is quite as long as the bird itself — 50 inches or more, and over two feet of it is coiled away in the keel of the breast-bone, which is entirely hollowed out to receive these extraordinary convolutions (fig. 99); the voice is singularly raucous and resonant. Temperate N. Am., but apparently of irregular distribution, not well made out; said to be or to have been common in the South Atlantic and Gulf States, and to have extended up the coast to the Middle States. Now scarcely known in the Eastern and Middle States. The chief line of migration appears to be in the interior, along the Mississippi Valley, Texas to Minnesota and Dakota, where the bird breeds, and thence spreading in the interior of the Fur Countries. So wild and wary a bird must be much influenced by the settlement of the country. Eggs 2 (or 3?), about 3.75 × 2.65, light brownish-drab, rather sparsely marked, except at great end, with large irregular spots of dull chocolate-brown, with paler obscure shell-markings; shell rough, with numerous warty elevations, and punctulate.

669. **G. canaden'sis.** (Of Canada.) NORTHERN BROWN CRANE. General character of the species next to be described; nakedness of head, and color of plumage substantially the same. Smaller; wing 18.00–19.00; tail 7.00; tarsus 6.75–8.00; bill along culmen 3.00–4.00! middle toe scarcely 3.00. Alula, edge of wing, primaries, and their shafts, black? Head of adult less naked? Supposed to be confined in the breeding season to Arctic America, thence migrating through *Western* U. S. to W. Texas, New Mexico, Arizona, and southward. (Supposed to be the true *G. canadensis* Linn., 1758, ex Edw. Is *G. fraterculus* Cass.? I must retain my doubts about this bird.)

670. **G. praten'sis.** (Lat. *pratensis*, relating to *pratum*, prairie, field.) SOUTHERN SAND-HILL CRANE. COMMON BROWN OR SAND-HILL CRANE. Adult with the bare part of the head forking behind to receive a pointed extension of the occipital feathers, not reaching on the sides below the eyes, and sparsely hairy. Bill moderately stout, with nearly straight and scarcely ascending gonys, that part of the under mandible not so deep as the upper at the same place. Adult plumage plumbeous-gray, never whitening; primaries, their coverts, and alula, ashy-brown, little darker than the general plumage, the shafts of the primaries white. Young with head feathered, and plumage varied with rusty brown. Nestlings quite reddish. Smaller than *G. americana*; larger than No. 669; length 44.00; extent 80.00; wing 22.00; tail 9.00; tarsus 9.50–10.00; bill along culmen 5.00–6.00; middle toe 3.50–4.00. This species has been said to lack tracheal convolutions, which is not true of the adult. The trachea is at first simple and straight, not entering the sternum; in the adult, about 8 inches of windpipe is coiled away in the breast-bone, the anterior half of the keel of which is excavated to receive the folds (fig. 100). The disposition is the same as in *G. americana*, but much less extensive — 8 inches as against about 27 — a difference in degree, not of kind. Temperate N. Am., rare or irregular in the east, very abundant in the south and west; apparently breeds in sufficiently wild places throughout its range. Eggs (2) cannot be distinguished from those of *G. americana* by color or texture of shell, or dimensions; the specimens examined average less capacious, and relatively more elongate; from 4.10 × 2.40, down to 3.65 × 2.10; average nearer 3.90 × 2.60; series probably including eggs of No. 669. (*G. canadensis* Auct., an Linn.?)

48. Family ARAMIDÆ: Courlans.

Consisting of a single genus, with probably only one species, of the warmer portions of America; closely allied to *Gruidæ* in essential points of structure, and forming a connecting link with *Rallidæ*. The osteological and pterylographic characters are completely crane-like;

the digestive system is as in the Rails; the cœca are two, situate close together. Carotids two; syringeal muscles one pair; femoro-caudal absent.

269. **A'RAMUS.** (Etym. ignot.) COURLANS. Bill twice as long as the head, slender but strong, compressed, grooved for about half its length, contracted opposite the nostrils, the terminal portion enlarged and decurved. Nostrils long, linear, pervious. Head completely feathered to the bill; tibiæ half bare; tarsus scutellate anteriorly, as long as the bill, longer than middle

FIG. 463. — *Parra jacana*, ½ nat. size. (From Brehm.)

toe; toes cleft, the hinder short, elevated, the outer longer than inner; wings short, rounded with falcate 1st primary, the inner quills folding over the primaries when closed; tail short, of 12 broad feathers.

671. **A. pic'tus.** (Lat. *pictus*, painted, spotted.) SCOLOPACEOUS COURLAN. CRYING-BIRD. CARAU. LIMPKIN. Chocolate-brown with a slight olivaceous or other gloss, paler on the face, chin, and throat, most of the plumage sharply streaked with white. Length 24.00–28.00; extent 40.00–44.00; wing 12.00–14.00; tail 6.00–7.00; bill and tarsus, each, about 5.00. Florida, and West Indies.

16. Suborder RALLIFORMES: Ralliform Birds.

Represented in North America by the three leading groups of *Rallidæ*—the Rails, Gallinules, and Coots. (For position of *Parridæ*, see below.)

49. Family PARRIDÆ: Jaçanás.

A small family of small wading-birds, of 3 genera and fewer than 12 species, combining characters of Plovers and Rails, outwardly distinguished from either by the excessive development of the toes and especially of the claws. These are slender, compressed, acute, nearly or quite straight; that of the hind toe much exceeding its digit in length. The spread of feet thus acquired enables the birds to run with ease over the floating vegetation of the marshes they inhabit. The American genus is *Parra* (fig. 363); the Old World genera are *Metopodius*, *Hydralector*, and *Hydrophasianus*. The systematic position of the family has been much questioned. On nearly all counts, it would appear to be *Limicoline*, not *Alectoridine*, and should be removed to the other order, next to *Charadriidæ*. The bill of *Parra* is quite plover-like; the spur on the wing and skin-flaps about the bill are like those of *Hoplopterus* and *Lobivanellus* (Plovers). With this understanding, I leave the family where I find it.

270. **PAR'RA**. (Lat. *parra*, name of some bird.) Jaçanás. Bill plover-like, contracted in continuity, enlarged terminally; with culmen depressed to end of nasal groove, then convex and decurved; outline of mandibular rami about straight to the gonys, which is ascending; commissure about straight to the decurved end. Nasal grooves along the contracted portion of the bill; nostrils small, elliptical, situate in advance of the base of the bill. Angle of mouth with a leaf-like lobe of skin (rudimentary in our species). Forehead with a large leaf-like lobe of skin, with free lateral and posterior edges, adherent centrally and anteriorly where reaching base of upper mandible. A sharp horny spur on bend of wing. Primaries 10, not peculiar in structure; outer 3 about equal and longest, overlaid by the inner quills in the closed wing. Tail very short, with soft rectrices concealed by the coverts. Tibiæ bare below, and with the tarsus scutellate before and behind, the scutella tending to become confluent in a continuous sheath. All the toes, claws included, longer than tarsus; middle toe alone nearly as long as tarsus; outer toe alone about as long as middle, its claw shorter than that of middle toe; inner toe a little shorter than outer, its claw longer; hind toe only about as long as basal joint of middle toe, but its claw much longer than itself; all the claws slender, about straight, very acute.

672. **P. gymno'stoma**. (Gr. γυμνός, *gumnos*, naked: στόμα, *stoma*, mouth. Fig. 53 *ter*.) Mexican Jaçaná. Adult: General plumage rich purplish-chestnut, brightest on wings and tail, darkest on back, breast, and sides, fading on lower belly. Quills pale yellowish-green, with dusky edging in increasing extent from the secondaries to the outermost primary; alula and primary coverts blackish. Bill, frontal leaf, and wing-spur yellow; base of upper mandible whitish, and space between it and the frontal leaf carmine; feet greenish; iris brown. Young: Grayish-brown above, streaked with brownish-yellow; below, buffy-whitish, darker across breast, the sides and lining of wings dusky; a light superciliary and dusky postocular stripe; wing-quills greenish-yellow as in adult; tail-feathers like upper parts. Frontal leaf rudimentary. Wing about 5.00; bill 1.25; tarsus, and middle toe without claw, 2.00. West Indies, Mexico, to Texas on the Lower Rio Grande.

50. Family RALLIDÆ: Rails, etc.

This is a large and important family, abundantly represented in most parts of the world. They are birds of medium and small size, generally with compressed body and large strong legs (the muscularity of the thighs is very noticeable), enabling them to run rapidly and thread

with ease the mazes of the reedy marshes to which they are almost exclusively confined; while by means of their long toes they are prevented from sinking in the mire or the floating vegetation. The wings are never long and pointed as among *Limicolæ*, being in fact of the shortest, most rounded and concave form found among waders; and the flight is rarely protracted to any great distance. The tail is always very short, generally of 10 or 12 soft feathers. Details of the bill and feet vary with the genera; but the former is never sensitive at the tip, and the latter have the hallux longer and lower down than it is in the shore-birds. The nostrils are pervious, of variable shape. The head is completely feathered; the general plumage is ordinarily of subdued and blended coloration, lacking much of the variegation commonly observed in shore-birds; the sexes are usually alike, and the changes of plumage not great with age or season. The food, never probed for in the mud, but gathered from the surface of the ground or water, consists of a variety of aquatic animal and vegetable substances. The nest is a rude structure, placed on the ground, or in a tuft of reeds or other herbage; the eggs are numerous, generally variegated in color; the young are hatched clothed. The general habit is gregarious, and migratory; many species occur in vast multitudes, though their skulking ways, and the nature of their resorts, withdraw them from casual observation. Some species swim habitually.

There appear to be upward of 150 species of the family, falling in several well-marked groups. The *Ocydrominæ* are an Old World type of some 35 species, ranking with some authors as a distinct family. Mr. Gray makes the African *Himantornis hæmatopus* the type and single representative of another subfamily. Excluding the *Parridæ* and *Heliornithidæ*, both of which are sometimes brought under *Rallidæ*, as subfamilies, the three remaining groups are represented in this country.

Analysis of Subfamilies and Genera.

RALLINÆ. *Rails.* No frontal shield, the feathers of forehead reaching bill. Toes simple. Body compressed.

- Bill slender, longer than head, curved, with long narrow nasal groove and linear nostrils . . . *Rallus* 271
- Bill stout, not longer than head, straight, with broad nasal groove and oblong nostrils . . *Porzana* 272
- As in the last; wings longer, folding nearly to end of tail . . . . . *Crex* 273

GALLINULINÆ. *Gallinules.* A bare horny frontal shield. Toes simple or merely margined. Body less compressed.

- Toes without evident lateral margins; nostrils oval . . . . . *Ionornis* 275
- Toes with lateral margins; nostrils narrow. . . . . *Gallinula* 274

FULICINÆ. *Coots.* A bare horny frontal shield. Toes lobate. Body depressed. Nostrils narrow *Fulica* 276

62. Subfamily RALLINÆ: True Rails.

FIG. 464.—Carolina Rail. (From Tenney, after Wilson.)

This is the largest, and central or typical, group, to which most of the foregoing paragraph is especially applicable. The species are strictly paludicole; the compression of the body is at a maximum; the form is blunt and thick behind, with a very short tip-up tail, and tapers to a point in front: the whole figure being thus adapted to wedge through narrow places. The wings are extremely short and rounded, and the ordinary flight appears feeble and vacillating, though the migrations of many species are very extensive. The tail has 12 feathers. The flank-feathers are commonly enlarged and conspicuously colored; the thighs are very muscular; the tibiæ are generally if not always naked below; the tarsi scutellate in front; the toes are long, cleft, without lobes or any obvious marginal membranes. The bill occurs under two principal modifications: in *Rallus* proper it is longer than the head, slender, compressed, slightly curved, long-grooved, with linear nostrils; in *Porzana* and most genera, however, it is shorter or not longer than the head, straight, rather stout,

with short broad nasal fossæ, and linear-oblong nostrils — altogether somewhat as in gallinaceous birds. The culmen more or less obviously parts antial extension of the frontal feathers, but never forms a frontal shield, as in the Coots and Gallinules. Of about 35 American species or varieties only 10 occur in this country, to which must be added one straggler from Europe. There are some 25 Old World species.

The Rails inhabit all temperate countries; they are remarkably distinguished by the extreme narrowness or compression of the body, which enables them to thread a way through the closest reeds and rushes of the marshes where they always live. Instead of long, flat, pointed, narrow wings, with flowing tertials, characteristic of the great Plover-snipe group, they have short, concave, rounded wings, and their flight is consequently of a different sort. They are neither swift nor vigorous on wing. When flushed, a matter of some difficulty, they fly in so feeble and vague a way that it is not very easy to understand how they make the extensive migrations for which, nevertheless, they are noted. The legs, as well as more particularly the feet, are large and strong; the thighs extremely muscular; they trust rather to these members than to their wings in avoiding pursuit or escaping danger; probably no birds are more accomplished pedestrians than they are. There is generally, if not always, a *slight* membrane between the base of the toes, but nothing amounting even to semipalmation; nevertheless, some of the species swim short distances with ease. While not exactly gregarious, since they do not go in flocks that are actuated by a common impulse and the instinct of socialism, nevertheless they frequent, through community of tastes and wants, the marshes in immense numbers; where they breed, and where they appear during the migration, particularly the autumnal, the marshes appear full-stocked with them. Their cries are loud, dry, and harsh; in the spring-time the marshes resound. They scream piteously when wounded and caught, and fight as well as they can with their strong claws. Their food consists of all sorts of aquatic animals small enough to be swallowed — little crabs, snails, and other small mollusks, grubs, worms, and insects. They probably all live at times, and in a measure at least, upon the seeds and tender shoots of aquatic plants. They lay many white or whitish, much-spotted, oval or elliptical eggs, in a rude flat nest, built of sticks, rush-stalks, and grasses, upon the ground. The young, of which more than one brood may be annually raised, are generally black in the downy state, whatever the color of the adults. They appear to be of somewhat nocturnal habits, and probably migrate mostly by night. The flesh of some of our species is esteemed good eating, and great numbers are annually destroyed for the table, in the fall, when they are generally very fat.

271. **RAL'LUS**. (Low Lat. *rallus*, a rail, from *rasle*, *râle*, a rattling cry.) Rails. Marsh Hens. Bill longer than head, slender, compressed, decurved, with long nasal groove extending beyond middle of bill. Nostrils linear, sub-basal. Hind toe not half as long as tarsus. Wings, tail, and legs as in *Rallinæ* at large. Plumage variegated above, plain below, excepting the conspicuously barred flanks, and lining of wings and tail. Sexes alike; young little different. Swamps and marshes exclusively. Eggs numerous, buff and spotted. Very clamorous in breeding season. We have 3 good species, one of them of 3 varieties.

Analysis of Species and Varieties.

Large: length 12.00 or more; wing 5.00 or more; bill 2.00 or more.
- **Flanks gray, with narrow white bars. Above, olive-brown or olive-gray without chestnut on wings; below, pale rufous or ashy.**
  - Upper parts olive-brown obscurely varied with olive-gray edges of the feathers; below with little rufous. Atlantic . . . . . *crepitans*. 673
  - Upper parts olive-gray, with obscure dark stripes below, breast quite rufous. Pacific *obsoletus* 674
  - Upper parts olive-gray with distinct dark stripes; below dull rufous. Gulf . . . . *saturatus* 675
- **Flanks dusky, with broad white bars. Above, variegated with olive-brown and blackish; wing-coverts quite chestnut; below, rich rufous** . . . . . *elegans* 676

Small: length under 12.00; wing under 4.50; bill under 1.00.
- Colors as in *elegans* . . . . . *virginianus* 677

673. **R. longirostris crepitans.** Lat. *longirostris*, long-billed. Lat. *crepitans*, crepitating, clattering. Fig. 465.) CLAPPER RAIL. SALT-WATER MARSH-HEN. MUD-HEN. ♂ ♀, adult: Above, variegated with dark olive-brown and pale olive-ash, the latter edging the feathers, the variegation dull and blended. Below, pale dull ochrey-brown, whitening on the throat, frequently ashy-shaded on the breast, without decided cinnamon-brown shade. Flanks, axillars, and lining of wings, fuscous-gray, with sharp narrow white bars. Quills and tail plain dark-brown, without chestnut on the coverts. Eyelids and short superciliary line whitish. The general tone is that of a *gray* bird, without any *reddishness*. Young mostly soiled whitish below; when just from the egg entirely sooty black. Length 14.00–16.00; extent about 20.00; wing 5.00–6.00; tail 2.00–2.50; bill 2.00–2.50; tarsus 1.67–2.00; middle toe and claw 2.00–2.33. ♀ smaller than the ♂. Salt marshes of Atlantic States, extremely abundant southerly; N. regularly to the middle districts, sometimes to Massachusetts. Resident from the Carolinas southward. Breeds in profusion in the marshes of the Carolinas, etc., where its clattering is almost incessant during the mating season. Nest a rude platform of reeds and grasses just out of the water on the ground. Eggs 6 to 12, averaging 1.67 × 1.12, whitish, creamy, or buff, variously speckled and blotched with reddish-brown, with a few obscure lavender marks.

FIG. 465. — Clapper Rail, reduced. (Altered from Lewis.)

674. **R. l. obsoletus.** (Lat. *obsoletus*, obsolete; referring to the markings of the upper parts in comparison with those of *R. elegans*.) CALIFORNIA CLAPPER RAIL. Back and scapulars grayish-olive, indistinctly striped with dusky; breast deep cinnamon. General aspect of the last, but quite reddish below. Wing 6.50; bill 2.25–2.50, its least depth 0.33; tarsus 2.10–2.25. Salt marshes of the California coast.

675. **R. l. saturatus.** (Lat. *saturatus*, saturated, satiated, i.e. dark-colored.) LOUISIANA CLAPPER RAIL. In general similar to *crepitans*; above, olive-gray or ashy, broadly striped with brownish-black; breast dull cinnamon. "Louisiana."

676. **R. elegans.** (Lat. *elegans*, choice.) KING RAIL. FRESH-WATER MARSH-HEN. With a general resemblance to *crepitans*, but larger and much more brightly colored. Adult ♂ ♀: Above, distinctly streaked with brownish-black and tawny-olive, the darker color being the central field of each feather; becoming rich chestnut on the wing-coverts, and plain dark brown on the hind-neck and top of head. Below, rich rufous or cinnamon-red, brightest on breast, fading on throat and belly; a line of the same over the eye, and dusky line through eye; lower eyelid white. Flanks and lining of wings blackish, broadly and distinctly barred with white; some of the crissal feathers similar. Specimens vary much in the richness of the tints and distinctness of the markings, but the reddish and streaky tone is always quite different from the dull blended colors of *crepitans*. Length 17.00–19.00; extent 23.00–25.00; wing 6.00–7.00; bill 2.10–2.50; tarsus 2.30; middle toe and claw about the same. U. S., rather southerly, Texas to the Middle States regularly, to Connecticut casually; in the interior to Kansas

and Missouri at least. Winters in the South. Inhabits preferably swamps and marshes above tide-water. Nesting the same as *crepitans;* eggs not distinguishable.

677. **R. virgin'ia-nus.** Virginia Rail. Coloration exactly as in *elegans*, of which it is a perfect miniature. Length 8.50–10.50; extent about 14.00; wing 4.00, always under 4.50; tail 1.50; bill 1.35–1.65; tarsus 1.25–1.50; middle toe and claw 1.50–1.75. Temperate N. Am., chiefly eastern U. S., migratory, abundant, both in fresh and salt marshes. Breeds commonly in New England; winters in the S. States and beyond. Although a regular migrant along the Atlantic coast, it never occurs in such immense numbers as the Carolina Rail. Eggs like those of the foregoing in color, but much smaller, about 1.25 × 0.95. They agree in size nearly with those of *Porzana carolina*, but the latter are greenish or drab, not buffy.

272. **PORZA'NA.** (Ital. *porzana*, Venetian name of *P. maruetta.*) Crakes. Bill shorter or not longer than head, stout, high and compressed at base, tapering, obtuse; nasal fossæ ample. Nostrils linear-oblong, near middle of bill. Otherwise generally as in *Rallus;* hind toe longer. Tarsus moderately shorter than middle toe and claw. Plumage of upper parts spotty as well as streaky. Small. Sexes alike. The 3 N. Am. species are very different (subgenerically), but *carolina* closely resembles *maruetta* of Europe.

Analysis of Species.

Small: length 8.00 or more. Face of adult blackish, the breast slate-gray.
  Bill orange, with red base. Breast spotted. (European.) . . . . . *maruetta* 678
  Bill not orange, without red base. Breast not spotted . . . . . *carolina* 679
Smaller: length about 6.00; wing over 3.00; yellowish-brown, barred with white . . *noveboracensis* 680
Smallest: length about 5.50; wing scarcely 3.00; blackish, speckled with white and chestnut *jamaïcensis* 681

678. **P. maruet'ta.** (Fr. *marouette*, name of this species.) European Spotted Crake. ♂ ♀, adult: Above, dark reddish-brown shaded with olive; hind neck finely dotted, other upper parts spotted and shortly striped with white, and marked with blackish. Below, slate-gray, fading to whitish on belly, the breast spotted with white, the flanks barred with white, the crissum buff. Top and front of head, and upper throat blackish, the crown streaked with this color and dark brown. Quills and tail dark olive-brown. Iris reddish-brown; bill orange, red at base; legs yellowish-green, livid on the joints. Length about 8.50; wing 4.75; tail 2.00; bill 0.85; tarsus 1.45; middle toe and claw 1.75. Young lack the black face; chin whitish. Europe. Only N. Am. as occurring in Greenland.

Fig. 466. — Carolina Rail. (From Lewis.)

679. **P. caroli'na.** (Fig. 466.) Carolina Crake. Common Rail. Sora. "Ortolan." Above, olive-brown, varied with black, with numerous sharp white streaks and specks; flanks, axillars

and lining of wings, barred with white and blackish; belly whitish; crissum rufescent. Adult ♂ ♀: Face and central line of throat black, the rest of the throat, line over eye, and especially the breast, more or less intensely slate-gray, the sides of the breast usually also with some obsolete whitish barring and speckling. Young: Without this black, the throat whitish, the breast brown. Length 8.00–9.00; extent 12.00–13.00; wing 4.00–4.50; tail about 2.00; bill 0.67–0.75; tarsus 1.33; middle toe and claw 1.67. Temperate N. Am., exceedingly abundant during the migration in the reedy swamps of the Atlantic States, in August and September, when tens of thousands are killed every year. Breeds from the Middle States northward: winters in the S. States and beyond. Has occurred in Greenland and Europe. The eggs are spotted just like those of the foregoing *Ralli*, but are readily distinguished by their strong drab ground-color instead of the white or creamy and pale buffy of the former. They are rather smaller than those of *R. virginianus*, and perhaps more obtuse, measuring about 1.20 by 0.90. This is *the* rail of sportsmen. It is also called *sora* or *soree;* the word is colloquial and local. The word "ortolan" has a curious connection with this species. It is Italian and French, equal to the Latin *hortulanus*, relating to a garden: the "ortolan" is *Emberiza hortulana*, a bunting, esteemed a great delicacy by gourmands; and our crake has been called *ortolan* for no better reason than that it is also edible and sapid! The same name is frequently applied to the bobolink, *Dolichonyx oryzivorus*, because it is found abundantly in the same marshes in the fall, and sells in the same restaurants as the same bird as the rail, the two being brought in together by the gunners.

680. P. noveboracen'sis. (Low Lat., of *Noveboracum*: i. e., New York.) YELLOW CRAKE. YELLOW RAIL. Adult ♂ ♀: Above, streaked with blackish and brownish-yellow, thickly marked with narrow white semicircles and transverse bars. Below, pale brownish-yellow fading on belly, deepest on breast, where many feathers are dark-tipped; flanks blackish with numerous white bars; crissum varied with black, white, and rufous. Lining of wings white. A brownish-yellow superciliary line, and dark transocular stripe. Small: about 6.00 long; wing 3.25; tail 1.50; bill 0.50; tarsus 0.87; middle toe and claw 1.12. Eastern N. Am., not abundant; N. to Hudson's Bay: winters in the S. States. Does not appear to have been observed in N. England N. of Mass., nor anywhere W. of the Mississippi Valley, Texas to Minnesota; but it is not common, is very secretive like other Rails, and readily eludes observation; its distribution may be more general than it is known to be. Eggs about 6, rich, warm, buffy-brown, marked at the great end with a cluster of reddish-chocolate dots and spots; 1.15 by 0.85, to 1.05 by 0.80; shape as in the foregoing.

681. P. jamaicen'sis. (Of Jamaica.) LITTLE BLACK CRAKE. Adult ♂ ♀: Upper parts blackish, finely speckled and barred with white, the hind neck and fore back dark chestnut. Head and under parts dark slate color, paler or whitening on the throat, the lower belly, flanks, and under wing and tail-coverts barred with white. Quills and tail-feathers with white spots. Very small: length about 5.50; wing 2.75–3.00; tail 1.35; tarsus 0.75. S. and C. America and W. I., not often found in the U. S., being one of the rarest of our birds. Observed N. to Mass., W. to Kan., and probably occurs across to the Pacific. Eggs from New Jersey are altogether different from those of the sora, or the yellow crake, being creamy-white, sprinkled all over with fine dots of rich, bright reddish-brown, and with a few spots of some little size at the great end; most like the more finely-speckled examples of the eggs of the large *Ralli*; dimensions 1.05 × 0.80.

682. P. j. coturni'culus. (Lat. dim. of *coturnix*, a quail.) FARRALLONE BLACK CRAKE. Like the last; rather smaller, the wing 2.50; more uniform in color, the back without white specks. Farrallone Islands, coast of California.

273. CREX. (Gr. κρέξ, *krex*, Lat. *crex*, a crake; referring to the creaking notes.) LAND RAILS. General character of *Porzana*. Wings much longer, folding nearly to end of tail. Tarsus relatively shorter. Plumage above streaky, but not spotty.

683. **C. praten'sis.** (Lat. *pratensis*, of fields.) European Land Rail. Corn Crake. Adult ♂ ♀: Upper parts blackish-brown, variegated with brownish-yellow, the wing-coverts both above and below rusty-reddish, the quills rufous-brown. Below, bluish-gray of varying intensity, more ashy-whitish on throat and belly, the flanks and crissum barred with reddish-brown. Line over eye like under parts; a dark brown stripe through eye. Bill and eyes brown; legs pale. Length about 10.50; wing 5.50–6.00; tail 2.00; bill 0.80–1.00; tarsus 1.60. Europe; casually in Greenland; accidental in New Jersey and Bermudas. (Wedderb., Zool., 1849, p. 2591; Cass., Pr. Phila. Acad., vii, 1855, p. 265; Reinh., Ibis, 1861, p. 11; Bd., Am. Journ. Sci., xli, 1866, p. 339; Freke, Zool., v, 1881, p. 374.)

63. Subfamily GALLINULINÆ: Gallinules.

Fig. 467. — European Gallinule, *Gallinula chloropus*. (From Dixon.)

Forehead shielded by a broad, bare, horny plate, a prolongation and expansion of the culmen. Bill otherwise much as in the shorter-billed rails, like *Porzana;* general form much the same, though the body is not so compressed; toes long, simple, or slightly margined. The Gallinules are somewhat Rail-like birds, of similar habits, inhabiting marshes; they agree with the Coots in possessing a frontal shield, but the feet are not lobate, nor is the body depressed, and the species swim no better than Rails. Some are of the richest and most elegant coloration. There are about 30 species of various parts of the world, constituting several genera, two of which, very distinct from each other, occur in N. Am.

274. **GALLI'NULA.** (Lat. *gallinula*, dimin. of *gallina*, a hen. Fig. 467.) Gallinules. Water Hens. Mud Hens. Bill not longer than head, stout at base, tapering, compressed, the culmen running directly up on the forehead and expanding into a frontal plate of different shape in different species. Nostrils near middle of bill, *linear*. Feet large and stout; tibiæ naked below; tarsus moderately compressed, scutellate; toes very long, the outer longer than the inner, *with* an evident though slight marginal membrane; claws long, slender, little curved, acute. Wings short and rounded, but ample. Tail very short, of 12 weak feathers, with long ample under coverts, as in Rails. Plumage not rich blue, etc. Several species of various countries.

684. **G. galea'ta.** (Lat. *galeata*, helmeted.) Common Gallinule. Florida Gallinule. Red-billed Mud-hen. Adult ♂ ♀: Head, neck, and under parts, grayish-black, darkest on the former, paler or whitening on the belly. Back brownish-olive. Wings and tail dusky; crissum, edge of wing, outer web of first primary, and stripes on the flanks, white. Bill, frontal plate, and ring round tibiæ, red, the former tipped with yellow; tarsi and toes greenish, the joints bluish; eyes red or brown. Young: Similar, but lacking the bright colors of the bill and legs, the former simply greenish; under parts extensively whitish. Length 12.00–14.00; extent 20.00–22.00; wing 6.50–7.50; tail 3.00; gape of bill about 1.50; tarsus about 2.00. S. Atlantic and Gulf States, N. sometimes to New England, to Canada West, Minnesota, Kansas, etc., and on the Pacific side to San Francisco; W. I., C. Am., and much of S. Am. Resident in the Southern States, and abundant coastwise. Nidification exactly that of the coot (beyond). Eggs 10–12–14, 1.75 × 1.25.

275. **IONOR'NIS.** (Gr. *ἴον, ion*, a violet; *ὄρνις, ornis*, a bird; alluding to the rich blue color.) Sultan Gallinules. Hyacinths. General character of *Gallinula;* bill very stout and

high, shorter than head, the nostrils near its middle, *oval*. Toes without lateral margins. Plumage beautiful with rich blue, etc.

685. **I. martinica.** (Of Martinique.) PURPLE GALLINULE. Adult ♂ ♀: Head, neck, and under parts beautiful purplish-blue, blackening on the belly, the sides and lining of wings bluish-green, the crissum white. Above, olivaceous-green, the cervix and wing-coverts tinted with blue. Quills and tail-feathers blackish, glossed on the outer webs with greenish. Frontal shield blue: bill carmine, tipped with yellow; legs yellow. The frontal shield is obovate, with a point behind. Young with the head, neck, and lower back brownish, the under parts mostly white, mixed with ochrey. Length 10.00–12.00; extent about 22.00; wing 6.50–7.00; tail 2.50–3.00; bill from gape about 1.25; tarsus about 2.25; middle toe and claw about 3.00. S. Atlantic and Gulf States, N. casually to New England, etc.; resident in the South. Also inhabits much of C. and S. Am., and W. I.

FIG. 468. — Frontal shield of a species of coot.

64. Subfamily FULICINÆ: Coots.

Bill and frontal plate much as in the Gallinules. Body depressed; the under plumage thick and duck-like, to resist water. Feet highly natatorial: toes, including the hinder, *lobate*, being furnished with large semicircular membranous flaps. The Coots are eminently aquatic birds, swimming with ease, by means of their lobate feet, like phalaropes and grebes: but this ability results from very slight modification of a structure shared by the Rails and Gallinules. There are about ten species, of both hemispheres, distinguished, among other characters, by the size and shape of the frontal shield. That, for instance, figured (fig. 468) is of an exotic species, much larger than that of *Fulica americana*, and differently shaped. One species is remarkable for having the forehead singularly caruncular: the others closely resemble our common species.

276. **FU'LICA.** (Lat. *fulica*, or *fulix*, a coot, from the sooty color: *fuligo*, soot.) Character essentially as above. Tarsi shorter than middle toe, stout, very broadly scutellate. Nostrils linear, in a broad fossa, towards middle of bill. Tibiæ bare below. Wings moderate, rounded, the 2d and 3d quills usually longest. Tail very short, 12-feathered. Plumage dark slaty color; sexes alike.

686. **F. america'na.** AMERICAN COOT. WHITE-BILLED MUD-HEN. CROW DUCK. Dark slate-color, paler or grayish below, blackening on the head and neck, tinged with olive on the back. Crissum, whole edge of wing, and tips of secondaries, white. Quills dusky, the outer edge of the first primary white. Tail blackish. Bill white or flesh-color, marked with reddish-black near the end and at base of frontal plate; feet dull olivaceous or livid yellowish-green; iris carmine; claws black. Young similar, paler and duller. Length 14.00–16.00; extent 23.00–27.00; wing 7.00–8.00; tail 2.00; bill from the gape 1.25–1.50; tarsus about 2.00; middle toe and claw about 3.00. The frontal plate is much smaller in this than in some other species, in which it covers all the forehead. Entire temperate N. Am., even to Alaska and sometimes Greenland; Mexico, Cent. Am., and W. I.; abundant, and breeds throughout its range; migratory northerly; resident in the South. Inhabits during the breeding season, and mostly, reedy sloughs, pools, and sluggish streams, seeking safety in concealment rather than by flight. Nesting most like that of grebes: a hollowed heap of bits of dead reeds, just out of the water, sometimes "floating" in the sense that the mass of broken-down reeds upon which it rests lies on the water. Eggs about a dozen, 1.75 to 2.00 long by 1.20 to 1.35 broad, shaped like an average hen's egg, clear clay-color, uniformly and minutely dotted with

dark brown, the spots usually mere pin-heads, sometimes large blotches. The nest is sometimes on dry ground a little away from water. The young hatch covered with black down, fantastically striped with bright orange-red, with vermilion bill tipped with black.

885. (addenda.) **F. a'tra.** (Lat. *atra*, black.) EUROPEAN COOT. Like the last. Bill, including frontal plate, entirely white; edge of wing, and of first primary, white, but no white on the crissum. Europe; only N. Am. as occurring in Greenland.

X. Order LAMELLIROSTRES: Anserine Birds.

Bill lamellate: that is, both mandibles furnished along their tomial edges with series of laminar or teeth-like projections, alternating and fitting within each other. Covering of bill membranous, wholly or in greatest part. Tongue fleshy, usually with horny tip, and serrate or papillate edges corresponding to the denticulations of the bill. Feet palmate; hallux elevated, free, simple, or lobed (rarely absent). Wings never exceedingly long, rarely very short. Tail generally short and many-feathered. Œsophagus narrower than in the lower flesh-eating orders, usually with a more or less specially formed crop; gizzard strongly muscular; intestines and their cœca long; cloaca capacious. Legs near centre of equilibrium; position of body in walking horizontal or nearly so. Reproduction præcocial. Sexual habit frequently polygamous. Diet various, commonly rather vegetarian than animal. There are two remarkably diverse types of lamellirostral birds, of more than family value, by some now made the bases of separate orders. The matter at issue may be here compromised by the recognition of two series, or suborders, as was done in the somewhat parallel cases of *Columbæ*, *Gallinæ*, and *Alectorides*.

17. SUBORDER ODONTOGLOSSÆ: GRALLATORIAL ANSERES.

Consisting of the single family of the Flamingoes; the *Odontoglossæ* of Nitzsch, the *Amphimorphæ* of Huxley, the *Phœnicopteridæ* of most authors. "The genus *Phœnicopterus* is so completely intermediate between the Anserine birds on the one side, and the Storks and Herons on the other, that it can be ranged with neither of these groups, but must stand as the type of a division by itself. Thus the skull has the long lacrymo-nasal region, the basipterygoid facets, the prolonged and recurved angle of the mandible, the laminated horny sheath of the *Chenomorphæ* [*Anatidæ*]; but the maxillo-palatines are spongy, and the general structure of the rostrum is quite similar to that found in Storks and Herons. The lower end of the crus is bare, but the feet are fully webbed; and the pterylosis is said by Nitzsch to be completely stork-like." (Huxley.) According to Garrod, two carotids are present, but the right is much larger than the left, which joins it low down in the neck (unique in detail, but similar to the disposition found in Bitterns and certain Parrots; fig. 94). The femoro-caudal is absent; the ambiens, accessory femoro-caudal, semitendinosus and accessory semitendinosus are present (differing both from *Herodiones* and *Anatidæ*). The tongue is thick, fleshy, papillate, with terminal nail, and closely tied down; œsophagus extremely narrow, with special crop; gizzard very muscular; intestines ample, both in length and calibre; two long cœca, constricted at base; a capacious cloaca. Bill of unique shape, but perfectly lamellate. General configuration of body and members grallatorial; legs and very slender neck exceedingly long, exhibiting even an exaggeration of the proportions of Cranes, Storks, and Herons; but toes webbed. The external characters are so nicely balanced between those of wading and swimming birds, that the Flamingoes have been placed indifferently in both groups; but nearly the whole organization corresponds essentially with that of the duck tribe, the grallatorial relationship, in form and habits, though so evident, being rather of analogy than of affinity. The physiological nature is said to be præcocial; the young hatching clothed and taking directly to the water.

51. Family PHŒNICOPTERIDÆ: Flamingoes.

Bill unique in shape, abruptly bent in the middle, so that the upper surface faces the ground in the act of feeding; in length much exceeding the head, very large and thick, entirely invested with membrane (without the distinct terminal horny nail of *Anatidæ*) Mandible narrower than maxilla at base, broader in the rest of its extent, ridged near the end Edges of upper mandible furnished with a great number (some 150) of oblique laminæ; of lower incurved, similarly furnished. Nostrils sub-basal, nearer commissure than culmen, linear, long. Tibiæ bare below for a great distance, and with the tarsi broadly scutellate before and behind. Toes short, the anterior palmate with incised webs; the hallux elevated, free,

FIG. 469. — American Flamingoes. (From a photograph of a group mounted by F. S. Webster.)

very small, or absent. Wings moderately long, ample, with enlarged inner secondaries folding over and beyond the primaries when closed. Tail short. There are about 7 species of Flamingoes, inhabiting the warmer parts of both Hemispheres; three of America besides ours, and three or four Old World. They represent several genera of late systematists, the most marked being that represented by *P. andinus*, which is three-toed. Our species falls in the restricted genus *Phœnicorodias* of Gray.

277. **PHŒNICO'PTERUS.** (Gr. φοινικόπτερος. *phoinikopteros*. Lat. *phœnicopterus*. a flamingo: *i. e.* red-wing.) FLAMINGOES. Character as above. Head bare between bill and eyes. Hind toe present. Claws flattened, obtuse. Wings ample, pointed; 1st three primaries subequal and longest; inner secondaries elongated and tapering.

687. P. ru'ber. (Lat. *ruber*, red. Fig. 469.) American Red Flamingo. Adult ♂ ♀ : Plumage scarlet, the primaries and most of the secondaries black. Legs lake-red. Bill black on the terminal part, orange in the middle, the base and bare skin of head yellow. Young the first year white or rosy. Stature nearly 5 feet; weight 6 or 8 lbs. Length about 4 feet; extent of wings 5 feet or more; wing 16 inches; tail 6; bill 5; tibia bare 9; tarsus 13; middle toe and claw 3½. ♀ like ♂ in color, but smaller. Florida and Gulf coast, and southward; said to have been N. to S. Carolina. Eggs 2, 3.25 × 2.10, with thick shell, roughened with white flaky substance, bluish when this is scraped away. The nest is described as a heap of earth and other material, which the birds bestride in an ungainly attitude; but it is not high enough to permit their long legs to dangle, as represented in some popular accounts and pictorial efforts. A recent writer upon one of the Old World species states positively that the incubating bird doubles her legs under her in the usual way; so that, unless the American species does differently, the accompanying illustration must be considered conventional. The young are said, on good authority, to take to the water as soon as hatched.

18. Suborder ANSERES: Anserine Birds Proper.

Simply equivalent to Lamellirostres as above defined, *minus* the Grallatorial type. For further characters, see on, under head of the single

52. Family ANATIDÆ: Geese, Ducks, etc.

Fig. 470. — Wild Duck.

Bill lamellate, stout, more or less elevated and compressed at base, widened or flattened at the obtuse tip, invested with soft, tough, leathery membrane, except at the end, which is furnished with a hard, horny "nail," generally somewhat overhanging, sometimes small and distinct, sometimes large and fused; that is, changing insensibly into the general covering. (This soft covering is regarded by some as a prolonged cere; but this is purely theoretical.) Body full, heavy, flattened beneath; neck of variable length; head large; eyes small. No antiæ; the frontal feathers encroaching on the culmen with a convex or pointed outline, and forming other projections on the sides of the bill, and in the interramal space, which latter is broad and long, the mandibular crura being united only at the end by a broad short bridge; no culminal ridge nor keel of gonys. Nostrils subbasal, median, or subterminal, elevated, open, naked, usually broadly oval. Wings of moderate length (rarely very short), stiff, strong, pointed, conferring rapid, vigorous, whistling flight; a wild duck at full speed is said to make ninety miles an hour. Tail of variable shape, but usually short and rounded, never forked, sometimes cuneate, of 12–24 feathers, usually 14–16, the under coverts very long and full, forming a conspicuous crissal tuft. Legs short; knees buried in the general integument; tibiæ feathered nearly or quite to the suffrago; tarsi reticulate or scutellate, or both; toes palmate, the hinder always present and free, simple or lobate. Wing occasionally spurred.

Like the gallinaceous, the anserine type is a familiar one, comprising all kinds of "waterfowl," among which are the originals of all our domestic breeds of swans, geese, and ducks, that vie with poultry in point of economic consequence, ornament our parks, or furnish exquisite material for wearing apparel, as well as the filling of our pillows and couches. But additional information respecting the structure of this, the largest and most important family of swimming birds, may be desirable. It is definitely characterized by many important points besides those external features just stated. In palatal structure, *Anatidæ* are desmognathous (fig. 78); "the lacrymal region of the skull is remarkably long [the lacrymal bone itself is large]. The basisphenoidal rostrum has oval sessile basipterygoid facets. The flat and lamellar maxillo-palatines

unite and form a bridge across the palate. The angle of the mandible is produced and greatly recurved" (*Huxley*). The interorbital septum is more or less completely ossified, and the orbits are better defined than in many birds, by well-developed lacrymal and post-frontal processes. The premaxillary is large, and its three prongs are so extensively fused that only a slight nasal aperture remains. Sometimes the top of the skull shows crescentic depressions for lodgment of the supraorbital gland, the secretion of which lubricates the nasal passages; but this feature is never so marked as in most of the piscivorous swimmers (fig. 63). The sternum is long and broad, more or less transverse posteriorly, with a simple notch or fenestra on each side; sometimes its keel is curiously hollowed out for a purpose stated beyond. The vertebræ vary a good deal in number, owing to the variability of the cervicals, which run up to 24 in some swans. The pelvis is ample, arched and extensively ossified, with small foramina, showing nothing of the straight, constricted, largely fenestrated figure prevalent among lower water-birds. The oil-gland is present, tufted. The carotids are two. The ambiens, femoro-caudal and its accessory and semitendinosus are present. The tongue is large and fleshy; its main bone (*glosso-hyal;* fig. 72) is highly developed; its sides show processes corresponding to the lamellæ of the bill. The gullet is not so ample as in the flesh-eating swimmers. The gizzard resembles that of a fowl in its shape and great muscularity; the muscles are deep-colored, and well show the typical disposition of large hemispherical lateral masses converging to central tendons. The cœca vary with the genera according to food; they are very long — 12 or 15 inches — in some of the herbivorous species. The male genital armature merits special notice. "In some *Natatores* which copulate on the water there is provision for more efficient coitus than by simple contact of everted cloacæ; and in the *Anatidæ* a long penis is developed. It is essentially a sacular production of a highly vascular part of the lining membrane of the cloaca. . . . In the passive state it is coiled up like a screw by the elasticity of associated ligamentous structure. . . . A groove commencing widely at the base follows the spiral turns of the sac to its termination; the sperm ducts open upon papillæ at the base of this groove. This form of penis has a muscle by which it can be everted, protruded and raised." (*Owen.*) Among the most interesting structures of the *Anatidæ* are the curious modifications of the windpipe, prevailing almost throughout the family. In a number of swans, this organ enters a cavity in the keel of the sternum, doubles on itself and then emerges to pass to the lungs, forming either a horizontal or a vertical coil. In some geese the windpipe coils between the pectoral muscles and the skin. These vagaries of the windpipe are not, however, confined to the present family, occurring in some of the cranes, ibises, certain *Gallinæ*, and also, it is said, in the curious snipe, *Rhynchæa capensis*. In most of the ducks, furthermore, and in the mergansers, the lower larynx is a singularly enlarged and complicated affair; several of the lower rings of the trachea being soldered together and greatly magnified to produce a large irregularly shaped capsule. Its use is not known; in some sense it is a sexual character, since it is only fully developed in the male; it varies greatly in size and shape in different species (figs. 3, 98). Finally, it should be added, that the pterylosis of the family is perfectly definite, a certain type of tract-formation prevailing throughout, with very slight minor modifications.

It is not easy to overrate the economic importance of this large family. It is true that the mergansers, some of the sea ducks, and certain maritime geese, that feed chiefly upon animal substances, are scarcely fit for food; but the great majority afford a bounteous supply of sapid meat, a chief dependence, indeed, with the population of some inhospitable regions. Such is the case, for example, in the boreal parts of this continent, whither vast bands of water-fowl resort to breed during the fleeting arctic summer. Their coming marks a season of comparative plenty in places where hunger often pinches the belly, and their warm downy covering is patched into garments almost cold-proof.

The general traits of the anserine birds are too well known to require more than passing

notice. They are salacious to a degree remarkable even in the hot-blooded, passionate class of birds; a circumstance rendering the production of hybrids frequent, and favoring the study of this subject. If we recall the peculiar actions of geese nipping herbage, and of ducks "dabbling" in the water, and know that some species, as the mergansers, pursue fish and other live prey under water, we have the principal modes of feeding. Nidification is usually on the ground; sometimes in a hollow tree; the nest is often warmly lined with live feathers; the eggs are usually of some plain pale color, as greenish, drab, or creamy; the clutch varies in number, commonly ranging from half a dozen to a dozen and a half. The young are clothed with stiffish down, and swim at once. Among the ducks and mergansers, marked sexual diversity in color is the rule; the reverse is the case with swans and geese. A noteworthy coloration of many species, especially of ducks, is the *speculum;* a brightly colored, generally iridescent, area on the secondary quills. Most of the species are migratory, particularly those of the northern hemisphere; the flight is performed in bands, that seem to preserve discipline as well as companionship; and with such regularity, that no birds are better entitled to the claim of weather-prophets.

There are upward of 175 species of this family, inhabiting all parts of the world. They differ a good deal in minor details, and represent a number of peculiar genera aside from the ordinary types, though none are so aberrant as to endanger the integrity of the group. It is difficult to establish divisions higher than generic, because the swans, geese, and ducks, if not also the mergansers, are closely united by intermediate genera. But the five groups presented as subfamilies in the following pages, and representing the whole of the family, may be conveniently recognized, and are readily distinguished, so far as our species are concerned, by the characters assigned. The genera will be found analyzed under heads of their respective subfamilies.

Analysis of Subfamilies.

CYGNINÆ. *Swans.* Lores partly naked. Tarsi reticulate. Hallux simple. Sexes alike.

ANSERINÆ. *Geese.* Lores feathered. Tarsi reticulate. Hallux simple. Sexes alike.

ANATINÆ. *River Ducks.* Lores feathered. Tarsi scutellate in front. Hallux simple. Bill flattened. Sexes unlike.

FULIGULINÆ. *Sea Ducks.* Lores feathered. Tarsi scutellate in front. Hallux lobate. Bill flattened. Sexes unlike.

MERGINÆ. *Mergansers.* Lores feathered. Tarsi scutellate in front. Hallux lobate. Bill cylindric. Sexes unlike.

65. Subfamily CYGNINÆ: Swans.

FIG. 471. — Mute Swan, *Cygnus olor.* (From Dixon.)

A strip of bare skin between the eye and bill; tarsi reticulate, and shorter than middle toe and claw; hind toe simple, or with very slight lobe. In the Swans, the neck is of extreme length and flexibility, exceeding the trunk, with up to 22 or 26 vertebræ; the movements and attitudes on the water are proverbially elegant and graceful. The bill equals or exceeds the head in length; it is high and compressed at base (where sometimes tuberculate), flatter and widened at the end; the nostrils are median. The lores are naked in the adults, though usually feathered in the young. Some of the inner remiges are usually enlarged, and when elevated in a peculiar position of the wing, they act as sails to help the course of the bird over the water. The reticulate tarsi are shorter than the middle toe and claw. The hallux is scarcely or not lobate. The legs are placed rather far back for this family, so that the gait is awkward and constrained. The

tail is short, of 20 to 24 feathers. Although the voice is sonorous at times, an habitual reticence of Swans contrasts strongly with the noisy gabbling of Geese and Ducks; it is hardly necessary to add, that their fancied musical ability, either in health or at the approach of death, is not confirmed by examination of their vocal apparatus: this is in many cases convoluted as already described, but there are no syringeal muscles nor other apparatus for modulating the voice. There are eight or ten species, of various countries, among them the celebrated black swan of Australia, *Chenopsis atrata*, the black-necked swan of South America, *Sthenelus melanocorypha* (*Cygnus nigricollis* of authors). The *Coscoroba anatoïdes* of the same country, a species with feathered lores, often referred here, is perhaps better placed among *Anatinæ*. In none of these does the trachea enter the breast-bone. The *Palæocycnus falconeri* is a large fossil species from Malta. Our two species belong to the restricted genus *Olor*, distinguished from *Cygnus* proper by absence of a tubercle at the base of the bill (seen in fig. 471). The sexes are alike throughout the group.

278. **CYG'NUS**. (Gr. κύκνος, *kuknos*, Lat. *cycnus* or *cygnus*, a swan.) WHITE SWANS. Neck of extreme length. Trachea normally entering sternum. Bill tuberculate or not, the skinny covering in the adults reaching to the eyes; not shorter than head, very high at base, where deeper than wide, broader and flattening toward the rounded end; culminal ridge at base about horizontal, very broad and flat or even excavated, the sides of the bill there nearly vertical. Nostrils near middle of bill, high up. Legs behind centre of equilibrium when the body is horizontal. Tibiæ bare below. Tarsus shorter than middle toe and claw, entirely reticulate; toes long, with full webs, the anterior reticulate on top for a distance, then scutellate. Hallux small, elevate, with slight lobe. Wings very long and ample. Tail short, rounded (in *Olor*) or wedged (in *Cygnus* proper), of twenty or twenty-four feathers. Size large: adults entirely white, with black bill and feet, former usually in part yellow: young rusty on head; younger gray or ashy. Sexes alike. Our species 4–5 feet long. They all belong to *Olor*, having non-tuberculate bill, rounded tail, the young with the down on the sides of the bill forming distinct antiæ; and the inner webs of the outer three primaries, with outer webs of the 2d, 3d, and 4th, sinuated.

Analysis of Species.

Tail of 24 feathers (normally). Bill entirely black, rather longer than head, nostrils fairly in its basal half . . . . . *buccinator* 688

Tail of 20 feathers (normally). Bill normally with a small yellow spot not reaching the nostrils, scarcely or not larger than head, nostrils at the middle . . . . . *columbianus* 689

Tail of 20 feathers (normally). Bill normally with a great yellow space extending beyond the nostrils, scarcely or not longer than head, nostrils at the middle . . . . . *musicus* 690

688. **C. buccina'tor.** (Lat. *buccinator*, a trumpeter; *buccina*, a trumpet; *bucca*, the cheek.) TRUMPETER SWAN. Adult ♂ ♀: Plumage white, with or without wash of rusty on head. Bill and feet entirely black. Bill more developed in the terminal portion than that of *C. americanus*, throwing the nostrils fairly within the basal half, and making the distance from the anterior angle of the eye to the hind edge of the nostril equal to the distance thence to the end of the bill. Tail-feathers normally 24. Largest: length 5 feet or more when full grown, and extent about 8 feet; wing 2 feet or more; tail 8–9 inches. Bill about 4.50 inches along culmen, from eye to tip nearly 6.00; tarsus 4.50–5.00; middle toe and claw 5.50–6.00. Young smaller; bill and feet not perfectly black; plumage grayish, the head and upper neck rusty-brown. This swan chiefly inhabits N. Am. from the Mississippi valley westward, Texas to the fur countries; Great Lakes; Hudson's Bay; Canada; casual on the Atlantic Coast. Breeds from Iowa and Dakota northward; in winter south to the Gulf.

689. **C. columbia'nus.** (Of the Columbia River. Fig. 472.) COMMON AMERICAN SWAN. WHISTLING SWAN. Adult ♂ ♀: Plumage as before. Bill with a yellow spot or blotch in front of eye, usually small, sometimes wanting. Bill less lengthened and expanded terminally than in *C. buccinator*, the nostrils across the middle; the distance from the anterior angle of the eye

to the hind edge of the nostril more than thence to the end of the bill. Tail-feathers normally 20. Length under 5 feet; extent 6 or 7 feet; wing under 2 feet; tail 7 or 8 inches. Bill about 4.00 along culmen; from eye to tip of bill under 5.00; tarsus 4.00; middle toe and claw 5.50. Young smaller; plumage ashy-gray, with reddish-brown wash on head and upper neck; bill in part flesh-colored, the lores plumulose; feet yellowish flesh-color. N. Am. at large, U. S. in winter and during the migration; the usual species along the Atlantic coast, and more numerous on either coast than in interior U. S.; rare or casual, however, in New England and eastward. Breeds only in the high north. Eggs 2–5, from 4.00 × 2.25 to 4.50 × 2.50, with rough dull white shell, with more or less brownish discoloration.

FIG. 472. — Whistling Swan. (From Lewis.)

690. C. mu'sicus. (Gr. μουσικός, *mousikos*, Lat. *musicus*, musical.) WHOOPING SWAN. Similar to *C. columbianus*, and having the same shape of the bill, but instead of a small yellow spot behind the nostrils there is a great yellow blotch, occupying one half or more of the bill and extending beyond the nostrils. Only N. Am. as occurring in Greenland: Reinh., Ibis, 1861, p. 13 of the reprint; Freke, Zoöl., v, 1881, p. 372.

691. [**C. be'wicki.** (To Thos. Bewick.) BEWICK'S SWAN. A European species, incorrectly attributed to N. A. in the 2d ed. of the Check List, which see, p. 111.]

66. Subfamily ANSERINÆ: Geese.

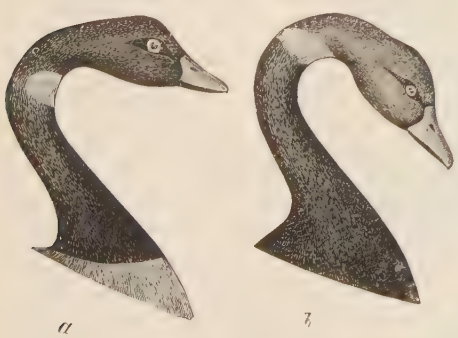


FIG. 473. — Common (*a*) and Black (*b*) Brant.

Lores completely feathered; tarsi entirely reticulate; hind toe simple. Neck in length between that of swans and of ducks; cervical vertebræ about 16; body elevated and not so much flattened as in the ducks; legs relatively longer; tarsus generally exceeding, or at least not shorter than, the middle toe; bill generally rather short, high and compressed at base, and tapering to tip, which is less widened and flattened than is usual among ducks and almost wholly occupied by the broad nail. The species as a rule are more terrestrial, and walk better, than ducks; they are generally herbivorous, although several maritime species (*Philacte*, and an allied South American group) are animal-feeders, and their flesh is rank. Both sexes attend to the young. A notable trait, shared by the swans, is their mode of resenting intrusion by hissing with outstretched neck,

and striking with the wings. With some exceptions the plumage is not so bright and variegated as that of ducks, and the speculum is wanting; there is only an annual moult, and no seasonal change of plumage; the sexes are generally alike. Most of the geese fall in or very near the genera *Anser* and *Bernicla*, and are modelled in the likeness of the domestic breeds. The more notable exotic forms are: the Australian *Anseranas melanoleuca* and *Cereopsis novæ-hollandiæ*, the former having the feet little more than semipalmate, the latter scarcely aquatic, with very long legs, much bare above the suffrago, and the bill small, very membranous; the African *Plectropterus gambensis*, a purplish-black bird with spurs on the wings and a tubercle at the base of the bill; the Asiatic *Cynopsis cygnoïdes*, frequently domesticated, a true goose with a swan-like aspect; the Egyptian goose, *Chenalopex ægyptiaca*. The geese appear to pass directly into the ducks through the rather large shieldrake group, the species of which resemble the latter in many external features, but are more essentially like geese. Characteristic examples of this group are the European *Tadorna vulpanser* and *Casarca rutila;* there are several others in the southern hemisphere; our long-legged arboricole genus *Dendrocygna* belongs in the immediate vicinity, while the domesticated musk duck, *Cairina moschata*, is not far removed. Through such forms as these we are brought directly among the ducks proper.

Analysis of Genera.

Bill pink; feet yellow; under parts extensively black. Bill tapering, not longer than head. Lamellæ moderately exposed . . . . . *Anser* 279

Bill and feet pink. Plumage white, or much varied. Bill tapering, not longer than head. Lamellæ completely exposed . . . . . *Chen* 280

Bill and feet black; head and neck black, with white spaces Bill tapering, shorter than head. Lamellæ hidden . . . . . *Bernicla* 282

Bill and feet light; plumage bluish, with black crescents. Bill tapering, not longer than head. Lamellæ partly exposed . . . . . *Philacte* 281

Bill and feet various; plumage much variegated. Bill scarcely tapering, longer than head *Dendrocygna* 283

Obs. — These characters only indicate the N. Am. species.

279. **AN'SER**. (Lat. *anser*, a goose.) Gray Geese. Bill shorter or not longer than head, very stout, tapering to obtuse tip, at base rather higher than broad. Lateral lamellæ somewhat exposed by bevelling of tomia. Nostrils in basal half of bill, their anterior edge only reaching its middle. Tibiæ naked below. Tarsus rather shorter than middle toe and claw, entirely reticulate. Anterior toes full-webbed, on top reticulate at base, then scutellate. Hind toe moderate, reaching the ground. Tail of 16 + feathers. Color not white, nor with black head, neck, bill, or feet; the bill pink, the feet yellow (in our species).

Analysis of Varieties.

Bill small; culmen 1.50–1.75 . . . . . *albifrons* 692

Bill large; culmen 1.75–2.00 . . . . . *gambeli* 693

692. **A. al'bifrons**. (Lat. *albus*, white; *frons*, forehead.) European White-fronted Goose. The above is the slight character which appears to separate this from the next. Only N. Am. as occurring in Greenland.

693. **A. a. gam'beli**. (To Wm. Gambel.) American White-fronted Goose. Speckle-belly. Tail normally 16-feathered. Bill smooth; the laminæ moderately exposed. Adult ♂ ♀: Bill pink, pale lake or carmine, the nails white. Feet yellow. Eyes brown. Claws white. A white band along base of upper mandible, bordered behind by blackish; upper tail-coverts white. Under parts whitish, the breast and belly more or less extensively patched or blotched with black, in high plumage perhaps mostly black, the sides of the rump, and the crissum, white. Head and neck dark grayish-brown, paler on the lower neck in front, where passing into the whitish black-blotched breast. Back dark ashy-gray, the feathers anteriorly tipped with brown, farther back with pale gray. Secondaries and ends of primaries dusky, more ashy toward base, the primary coverts and outer webs of primaries ashy, the greater coverts and secondaries bordered with whitish, the primaries and coverts edged and tipped

with white; shafts of quills white. Young: Darker, browner; the gray and ashy colors rather brown, the base of the tail not pure white, no white on forehead, which is darker than rest of head, no black on under parts, the bill obscured, the nail blackish, the feet pale. Length about 27.00 inches; extent 60.00; wing 16.10–17.00; tail 5.50; tarsus 2.75; middle toe and claw rather more; bill up to 2.00. N. Am. at large, breeding in the far north, wintering in the U. S., in greater numbers on the Pacific side than in the interior or along the Atlantic. Eggs 6–7, 2.90 to 3.30 long by 2.10 broad, elliptical, smooth dull yellowish with an olive shade, in places discolored with a darker tint.

280. **CHEN**. (Gr. χήν, *chen*, a goose.) SNOW GEESE. Bill about as long as head, very stout and high at base, where higher than broad, the under mandible very deep. Tomial edges of much bevelled off, and receding from each other, leaving an elliptical space, in which the large prominent teeth are fully exposed. Nostrils in basal half of bill. Feet as in *Anser*, but tarsus if anything longer than middle toe and claw. Color white, at least on head. Bill and feet reddish.

Analysis of Species.

Not white. Nearly the size of the next	*cærulescens*	694
Pure white, with black wing-tips; head rusty or not.		
Large: length about 30.00; wing 17.00 or more. Bill smooth	*hyperboreus*	695
Small: length about 25.00; wing 16.00 or less. Bill smooth	*albatus*	696
Very small: under 24.00; wing 15.00 or less. Bill studded with papillæ	*rossi*	697

694. C. cærules'cens. (Lat. *cærulescens*, bluish.) BLUE SNOW GOOSE. Bill and feet flesh-pink, former with the recess between the mandibles black, the nails whitish; iris dark brown; claws dusky. Head and neck above white, the neck below, passing on to the back and breast, dusky-gray, then fading into whitish on the under parts, changing on the wings into fine bluish-gray, or silvery-ash; rump and upper tail-coverts whitish; quills and tail-feathers dusky, edged with whitish, the primaries black. Size of the snow goose or rather less, and closely resembling the young of that species. Length about 25.00; wing 16.00; bill 2.25; tarsus 3.00. N. Am. at large, not very common or well-known.

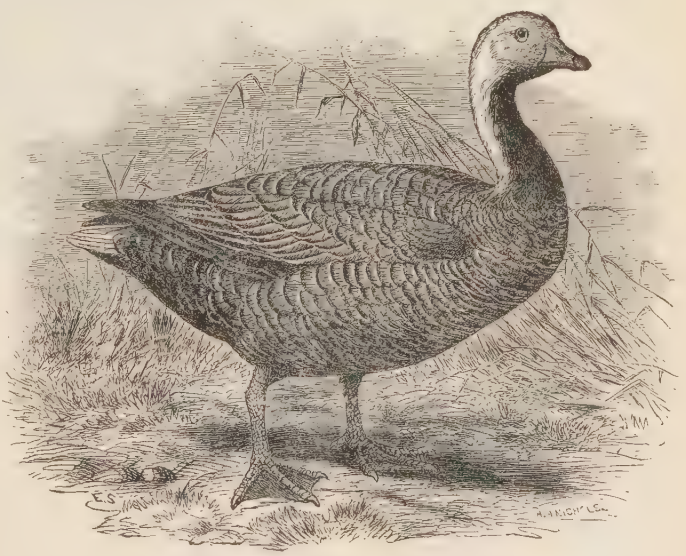


FIG. 474. — Emperor Goose. (From Dall.)

695. C. hyperbo'reus. (Lat. *hyperboreus*, beyond the north wind.) SNOW GOOSE. WHITE BRANT. Bill carmine-red or pale purplish with a salmon tinge, the nails white, the recess between the mandibles black. Eyes dark brown. Feet dull lake-red, the claws blackish. Adult plumage pure white, the head usually washed with rusty-brown, like a swan's, the ends of the primaries blackening. Young resembling the last, but the head not white while other parts are colored. Large: length 27.00–31.00; extent 57.00–62.00; wing 17.00–19.00; tail 6.50; bill 2.35–2.60; tarsus 3.00–3.50; middle toe and claw the same. Weight 5 or 6 lbs. The dimensions grade down

to those of the next. N. Am. at large; breeds in high latitudes, migrating and wintering in the U. S. Abundant in the interior and along the Pacific coast, less so on the Atlantic. Casual in Europe. Eggs about 3.00 × 2.00, yellowish-white.

696. **C. h. alba/tus.** (Lat. *albatus*, whitened.) LESSER SNOW GOOSE. Coloration precisely as in the last; size less, but grading up to that of *hyperboreus*. Length about 25.00; wing 15.50; tail 5.50; bill 2.00–2.12; tarsus 2.90–3.00. Western N. Am., probably also Eastern; accidental in Ireland.

697. **C. ros/si.** (To B. R. Ross.) ROSS' GOOSE. HORNED WAVEY. LEAST SNOW GOOSE. Coloration as in the foregoing. Bill with the outline of the feathers on the side nearly straight instead of strongly convex, studded at base with numerous papillæ, and less exposure of the teeth. Very small, no larger than a mallard duck. Length about 21.00; wing 14.50; tail 5.00; bill 1.50; tarsus 2.50. Arctic America, U. S. in winter, western. A curious little white goose, so different from the other species of *Chen* as to have been made type of a genus *Exanthemops*.

281. **PHILAC/TE.** (Gr. φίλος, *philos*, loving; ἀκτή, *akte*, the seashore.) PAINTED GEESE. Superficial aspect of *Chen*. Skull with superorbital depressions (wanting in other N. Am. geese). Teeth of bill exposed posteriorly; the nail prominent; bill moderately robust. Tarsus not longer than middle toe and claw. Plumage variegated, but no metallic tints; bill and feet light-colored. Webbing of the toes incised. Sexes alike. Arctic and maritime.

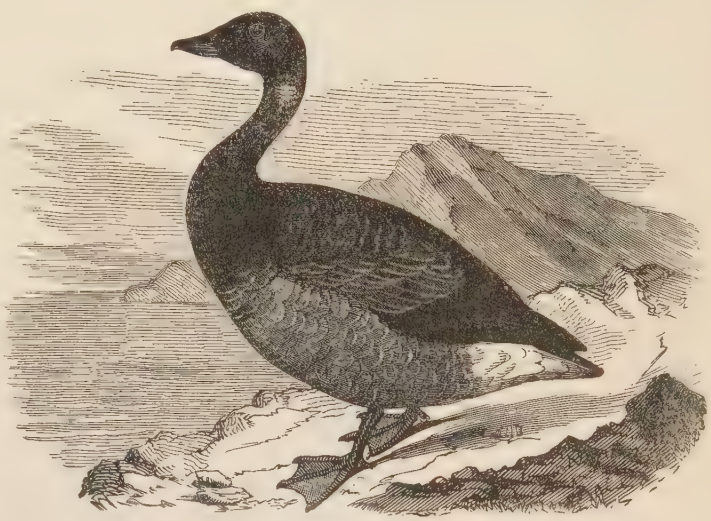


FIG. 475. — Common Brant. (From Lewis.)

698. **P. cana/gica.** (Of the island of Kanaga. Fig. 474.) PAINTED GOOSE. EMPEROR GOOSE. Wavy bluish-gray, with lavender or lilac tinting, and sharp black crescentic marks; head, nape, and tail white, former often washed with amber-yellow; throat black, white-speckled; quills varied with black and white; eye brown; feet flesh-color. Length 25.00–28.00; wing 15.00–17.00; tail 5.00–6.00; bill 1.50; tarsus 3.00. N. W. coast; abundant at mouth of Yukon; wintering chiefly in S. Alaska and the Aleutian Islands, breeding N. to Behring Strait at least; also on the Siberian side. A remarkable species, unlike any other goose of our country; strictly maritime. Its flesh is rank, and scarcely fit for food. Eggs about 5, 3.35 × 2.00, white, with fine pale brown dotting, giving a general pale dirty-brown color.

282. **BER/NICLA.** (Latinized from English *barnacle*.) BARNACLE GEESE. BRANT GEESE. Bill short, the nostrils at its middle. Laminæ of bill not exposed, the commissure being straight. Head and neck black, with white spaces. Bill and feet black. Hind toe very small. Tail of 16–18 feathers. Sexes alike. Several species, of both Hemispheres. (The name "barnacle" commemorates the fable that these birds sprouted from the little cirripeds called barnacles; "brent" or "brant" is simply "burnt" goose, from the dark color, as if charred.)

Analysis of Species and Varieties.

Forehead, cheeks, and chin white. (European.) . . . . . *leucopsis* 699
Forehead, cheeks, and chin black; white stripes on neck.
  Black of neck well defined against light lower parts . . . . . *brenta* 700
  Black of neck extending over breast . . . . . *nigricans* 701
Forehead black; cheeks and chin white; no white stripes on neck.
  Tail normally 18-feathered. Large.
    No white collar in black of lower neck . . . . . *canadensis* 702
    A white collar in black of lower neck . . . . . *occidentalis* 702*a*
  Tail normally 16-feathered. Small.
    No white collar in black of lower neck . . . . . *hutchinsi* 704
    A white collar in black of lower neck . . . . . *leucoparia* 703

699. B. leucop'sis. (Gr. λευκός, *leucos*, white; ὄψις, *opsis*, appearance: the face white.) Barnacle Goose. Tail normally of 16 feathers. Bill, feet, and claws black. Iris brown. Front and sides of head and chin white, with a dark line at base of bill, and thence to eye. Rest of head and neck all around black, prolonged on the back and wings, the feathers of the latter bluish, gray at base and edged at end with whitish; rump and tail black. Upper and under tail-coverts, sides of rump, belly, and hind breast, white or whitish, the sides shaded with gray. Quills dusky, blackening at ends, tinged on the exposed surfaces with ashy. Sexes similar; ♀ duller colored and smaller than ♂. Length of ♂ 28.00; extent 55.00; wing 17.00; tail 6.00; bill 1.50; tarsus 2.75; middle toe and claw the same. Europe; very rare and casual in N. Am. excepting Greenland, where regular. (Hudson's Bay, Am. Nat., ii, 1868, p. 49. N. Carolina, Am. Nat., v, 1871, p. 10. Long Island, Bull. Nutt. Club, ii, 1877, p. 18. Illinois, Forest and Stream, Nov. 23, 1876.)

Fig. 476. — Black Brant. (From American Field.)

700. B. bren'ta. (Quasi-Lat. *brenthus*, *brentus*, burnt. Fig. 475.) Brant Goose. Bill, feet, and claws black; iris brown. Head and neck all around, and a little of fore part of body, glossy-black, well defined against the color of the breast; on each side of the neck a small patch of white streaks; frequently also white touches on eyelid and chin. Breast ashy-gray, beginning

abruptly from the black, fading on the belly and crissum into white, shaded along the sides of the body; upper parts brownish-gray, the feathers of the dorsal region with paler gray tips; rump darker; upper tail-coverts white. Tail-feathers, wing-quills, and primary-coverts blackish, the inner quills whitish toward base. Length 24.00; extent 48.00; wing 13.00; tail 4.50; bill 1.33; tarsus 2.25; middle toe and claw about the same. Europe. In North America, chiefly along the Atlantic Coast, being more maritime than other U. S. geese, but still found inland on the great lakes and rivers. U. S. only in winter, and during the migrations, when abundant. Breeds in high latitudes, to the Arctic Coast.

701. B. b. nigricans. (Lat. *nigricans*, being blackish. Fig. 476.) BLACK BRANT. Similar to the last: black of jugulum extending over most of under parts, fading on belly and crissum, without abrupt line of demarcation on breast; white neck-patches usually larger and meeting in front. Size of the last. Both coasts; very abundant on the Pacific side, not common on the Atlantic. Migrations and breeding resorts the same.

702. B. canaden'sis. (Of Canada. Fig. 477.) CANADA GOOSE. COMMON WILD GOOSE. Tail normally 18 - feathered. Bill, feet, head, and neck black: on the chin a broad white patch mounting on sides of head behind eyes, sometimes broken on chin; not extending forward to jaws; white touches usually on eyelids. Upper tail-coverts definitely white; rump blackish; tail-feathers black. General color brownish-gray, paler or more ashy-gray below, all the feathers with paler gray or whitish edges, those of sides of body usually darker than rest of under parts, the lower belly and crissum definitely white. Iris brown. Length 3 feet or more; extent 5 feet; wing 18-20 inches; tail 7.00; tarsus 3.00–3.50; middle toe and claw more; bill about 2.00. N. Am. at large. This is the most generally distributed and on the whole the most abundant goose of our country. It breeds in various parts of the U. S., sometimes *in trees*, but the greater number of individuals pass further north to nest. Eggs 5 to 9, usually 5 or 6, ellipsoidal, smooth, pale dull greenish, about 3.50 × 2.50.

FIG. 477. — Canada Goose. (From Lewis.)

702a. B. c. occidenta'lis. (Lat. *occidentalis*, western.) LARGER WHITE-CHEEKED GOOSE. Similar to the last; of equal size, and tail 18-feathered. Coloration averaging darker than in the last, the under parts especially, against which the white of the anal and crissal region is well-defined. Black of neck bounded below in front by a white half-collar. Bill averaging shorter, and tarsus relatively longer. The best samples are well marked; others shade into the common form. Pacific coast, especially Alaska. (The bird here indicated is *B. occidentalis* Bd. Whether

leucoparia Brdt.? But not *leucoparia* Cass. Not in the Check List, 1882, not having been there formally recognized as a subspecies.)

703. **B. c. leucopari'a.** (Gr. λευκός, *leukos*, white; παρειά, *pareia*, cheek.) SMALLER WHITE-CHEEKED GOOSE. Similar to the last in color; but much smaller, and tail 16-feathered, thus resembling No. 704, from which distinguished as *occidentalis* is from *canadensis*. Length 24.00 or less; wing about 15.00. This is the small "white-necked goose" figured by Cassin, Ill., pl. 45, as *B. leucoparia*, Brandt. Pacific coast, especially Alaska.

704. **B. c. hut'chinsi.** (To Mr. Hutchins.) HUTCHINS' GOOSE. Tail normally 16-feathered. Coloration as in the Canada goose. Size much less. Length 25.00–30.00; extent about 4 feet; wing 15.00–17.00; tail 5.00–6.00; bill 1.50; tarsus under 3.00. There seems little probability of establishing good character of more than one species of the *canadensis* group, with probably four varieties: large, no collar (702); small, no collar (704); large, collared (702*a*); small, collared (703).

283. **DENDROCY'GNA.** (Gr. δένδρον, *dendron*, a tree; Lat. *cygnus*, a swan.) TREE DUCKS. Duck-like arboricole geese, with the bill longer than the head, terminated by a prominent decurved nail, the lamellæ not projecting; nostrils small, oval, in basal half of bill; legs very long, the tibiæ extensively denuded below; hind toe lengthened, more than one-third as long as the tarsus; tarsi entirely reticulate, as in geese proper. Wings ample, rounded; 1st quill shorter than 4th. Coloration variegated. Sexes similar. Nest in trees. In addition to the two following species, a third, *D. arborea*, of the West Indies, may occur in the South.

Analysis of Species.

Bill and feet blackish; coloration largely cinnamon; no white wing-patch . . . . . *fulva* 705
Bill and feet reddish; coloration largely blackish; a large white wing-patch . . . . . *autumnalis* 706

705. **D. ful'va.** (Lat. *fulva*, fulvous, reddish.) FULVOUS TREE DUCK. Bill bluish-black; feet slaty-blue. Pale cinnamon or yellowish-brown, extensive and uniform on the lower parts, darker on head; nape and hind-neck with a black line; scapulars and fore-back blackish with pale cinnamon edgings of the feathers. Rump and tail black; upper and under tail-coverts white. No white speculum on wing; lesser wing-coverts chocolate-brown; rest of wing black on both surfaces. Length about 20.00; extent 36.00; wing 9.50; tail 3.25; tarsus 2.25; bill 1.50, with hooked nail. S. W. U. S. and southward, in summer, Louisiana to Cala.; common on the Rio Grande.

706. **D. autumna'lis.** (Lat. *autumnalis* or *auctumnalis*, of the period of *increase*, of harvest; *auctus*, increased, augmented.) AUTUMNAL TREE DUCK. Bill coral-red, with orange above, and bluish nail; feet pinkish-white. A large white speculum, consisting of greater wing-coverts and basal parts of most of the quills, as well as spurious quills and outer webs of one or two primaries. Head and neck reddish-chocolate, paler on cheeks and chin, with black stripe down nape and hind-neck, passing through more yellowish-brown on the fore-parts of the body to blackish on lower back, rump, tail, belly, sides of body and lining of wings; flanks and crissum mostly white. Length about 20.00; extent 36.00–38.00; wing 9.50–10.50; tail 3.00; bill along gape 2.00; tarsus 2.25. S. and C. Am. and Mex. to Texas, abundant from April to October on the Rio Grande, where called "cornfield duck;" a common market-bird in some places. Nest in hollows of trees, often at a great distance from water, to which the young are transported by the parents in the bill. Eggs 12–16, 2.10 × 1.50, of usual duck shape, buffy-white.

67. Subfamily ANATINÆ: River Ducks.

Tarsi scutellate in front; hind toe simple (in *Fuligulinæ*, the hind toe with a flap or lobe.) This expression separates the present group from all the North American examples of the foregoing and succeeding subfamilies, although it is not a perfect diagnosis. The neck and legs are shorter than they average in geese, while the feet are smaller than in the sea-

ducks, the toes and their webs not being so highly developed. None of the *Anatinæ* are extensively maritime, like most of the *Fuligulinæ;* yet they are by no means confined to fresh waters, and some species constantly associate with the seaducks. They feed extensively, like most geese, upon succulent aquatic herbage, but also upon various animal substances; their flesh is almost without exception excellent. They do not dive for their food. The moult is double; the sexes are almost invariably markedly distinct in color; the young resemble the ♀; the wing has usually a brilliant speculum, which, like the other wing-markings, is the same in both sexes. Unlike geese, these and other ducks are not doubly-monogamous, but simply so if not polygamous; the male pays no attention to the young. Excluding the shieldrake group, already mentioned as pertaining rather to the geese than the ducks, there are about fifty species, generally distributed over the world.

Fig. 478. — Mallards. (From Lewis.)

They are split into a large number of modern genera, most of which indicate little more than specific characters; the majority are represented in this country. Of those here following, two, *Spatula* and *Aix*, represent decided structural peculiarity; the rest might all be referred to *Anas*, type of the group. The *Malacorhynchus membranaceus*, of Australia, is a notable exotic form.

Analysis of Genera.

Head crested; bill narrow, the tip formed widely by the nail . . . . . *Aix* 290
Head not crested; bill greatly wider at end than at base . . . . . *Spatula* 289
Head not crested; bill not spoon-shaped.
  Tail cuneate, with narrow central feathers more than half as long as wing . . . . . ♂ *Dafila* 285
  Tail not cuneate, not half as long as wing
    Bill shorter than head; tail-feathers lance-acute; head not white; belly white yg. and ♀ *Dafila* 285
    Bill shorter than head; tail-feathers not acute; crown and belly white . . . . . *Mareca* 287
    Bill about as long as head, or longer.
      Wing-speculum white; wing-coverts chestnut; bill dark; feet orange . . . *Chaulelasmus* 286
      Wing-speculum violet, black-bordered; bill greenish, or dusky and orange; feet orange *Anas* 284
      Wing-speculum green; lesser coverts blue or not; bill dark. Very small . . *Querquedula* 288

Obs. — The old males of all our species are unmistakable, having strong marks of color, size, and form; but the females and young may not always be recognized at a glance. In examining any "duck" of which you are in doubt, first notice the *bill;* if it is narrow and cylindrical, with sharp saw-like teeth, very conspicuous, the bird is one of the *Mergansers*, or "Fishing Ducks," scarcely fit for food. Next, examine the *hind toe:* if it has a flap or lobe hanging free, the bird is one of the *Fuligulinæ*, which may or may not be good for the table; if the hind toe is simple and slender, it is one of the *Anatinæ*, and sure to make a good dish, if in order. All the red- or orange-footed species are *Anatinæ* (*excepting* the Mergansers); but not all the *Anatinæ* have the feet thus colored. In determining female and young *Anatinæ*, look to the wing-markings rather than the body-colors. The species of *Querquedula* are very small "teal" ducks, 16 inches or less in length.

284. A'NAS. (Lat. *anas*, a duck.) Common Ducks. Mallard and Black Ducks. Bill not shorter than head, rather longer than tarsus, broad and about parallel-sided, higher than wide at base, then much depressed and flattened, the end rounded, the nail narrow, less than one-third as wide as the end of the bill. Nostrils high up, in basal half of bill. Feathers reaching to about the same distance on forehead, cheeks, and chin. Tail rounded, less than half as long as wing, of 16–18 pointed feathers. Bill greenish, or blackish blotched with orange. Feet bright-colored. Speculum violet, etc., framed in black and white (in both sexes). Sexes unlike (*boscas*) or alike (*obscura*).

Analysis of Species.

♂ Head and neck green, neck with white ring, breast purplish-chestnut, etc. ♀ variegated with dusky and yellowish-brown . . . . . *boscas* 707

♂ ♀ entirely dusky, variegated with yellowish-brown ; lining of wings white . . . . . *obscura* 708, 709

707. A. bos'cas. (Gr. *βοσκάς*, *boskas*; Lat. *boscas* or *boscis*, probably this very species. Fig. 478.) Mallard. Wild or Domestic Duck. Green-head. Adult ♂: Bill greenish-yellow. Feet orange-red. Iris brown. Head and upper neck glossy-green, succeeded by a white ring. Breast purplish-chestnut. Lower back, rump, and tail-coverts glossy-black. Tail-feathers mostly whitish. Under parts from the breast, and scapulars, silvery-gray, finely undulated with dusky; crissum black. Speculum violet, purplish and greenish, framed in black and white tips of the greater coverts, and black terminal border. ♀, adult: Feet and wings as in the ♂, Bill blackish, blotched with orange, especially at base, tip and along edges. Entire body-colors with dusky-brown and tawny-brown; the tone paler and in finer pattern on the head, neck, and under parts than on the back. Length 22.00–24.00; extent 32.00–36.00; wing 10.00–11.00; tail 3.00–4.00; bill about 2.00; tarsus rather less; middle toe and claw more. In the drake, a tuft of curly feathers on tail. Weight 2 or 3 pounds. Habitat nearly cosmopolitan; nearly everywhere domesticated, being the well-known original of the barn-yard duck. Wild in abundance throughout N. Am., breeding sparingly in the U. S. as well as farther north; rare in New England, and scarcely found beyond Massachusetts, being replaced farther N. E. by the dusky duck. Nest on ground, of trash and feathers; eggs usually 8–10, 2.25 × 1.60, smooth, dingy yellowish-drab.

Obs. — An anomalous duck, with the general aspect of a mallard, but nearly as large as a goose, is occasionally taken on the Atlantic coast; it is unquestionably part mallard, the balance of its parentage supposed to be muscovy; *Anas maxima* Gosse; *Fuligula viola* Bell. — A supposed hybrid of mallard × gadwall is *Anas glocitans* or *A. breweri* Aud.; *A. auduboni* Bp. The mallard is known to × with various other species. Upwards of 50 kinds of hybrid ducks are recorded; some of them prove fertile. There is even a *Clangula* × *Mergus*.

708. A. obscu'ra. (Lat. *obscura*, dark.) Dusky Duck. Black Duck. Size of the mallard, and resembling the ♀ of that species, but darker and without white anywhere except the lining of the wings in ♂ ♀, and a narrow white line along proximal border of speculum of ♂. Sexes alike. Bill yellowish-green, with dusky nail; feet orange-red, with dusky webs. Iris brown. General plumage dusky-brown, paler below than above, variegated with pale rusty-brown edgings of the feathers; top of head darker than sides and throat, the former blackish with pale brown streaking in fine pattern, the latter grayish-brown with dark streaking. Wing-coverts dusky-gray; the greater tipped with black, edging the purplish-blue or violet speculum. The general blackish color, contrasting with white lining of wings, and the violet speculum framed in velvety-black, are diagnostic. ♀ *boscas* is much lighter in tone, and more variegated with tawny-brown. Chiefly Eastern N. Am.; Western ? Abundant along the Atlantic Coast, Texas to Labrador. One of the commonest ducks in summer in New England and N. E.-ward. W. to Kansas, Iowa, etc., but not positively known beyond. Nest on ground, of weeds, grass, and feathers; eggs 8–10, dirty pale yellowish-drab, about 2.30 × 1.75. One of the best table ducks.

709. A. o. fulvi'gula. (Lat. *fulvus*, reddish: *gula*, throat.) FLORIDA DUSKY DUCK. Similar; lighter-colored; throat plain pale brownish: bill olive, with black nail and base of commissure. A local race, resident in Florida.

285. DA'FILA. (A non-sense word.) PIN-TAIL DUCKS. Tail (in adult ♂) narrow, cuneate, when fully developed nearly as long as wing, the 2 central feathers long-exserted, linear-acute: in ♀ and young the tail merely tapering, with acute feathers; tail-feathers 16, including the long middle pair. Bill shorter than head, longer than tarsus, nearly parallel-sided, widening a little to the end, the nail small, the narrow nostrils high up in basal third of bill. Feathers of cheeks sweeping in strongly convex outline along side of upper mandible, beyond those on side of lower mandible. Wing acute, the 1st and 2d primaries subequal and longest, rest rapidly graduated. Neck unusually long and slender, and form less "stocky" than that of most ducks. Sexes and young very unlike in color, even to the wing-markings, as well as in shape of tail. Bill and feet dark. Under parts white or whitish. Speculum of ♂ framed in buff, white, and black.

FIG. 479. — Head of *Dafila*, ♀, nat. size. (Ad nat. del. E. C.)

710. D. acu'ta. (Lat. *acuta*, acute, as the tail is. Figs. 479, 480.) PIN-TAIL DUCK. SPRIG-TAIL. Adult ♂: Bill black, with grayish-blue edge of upper mandible; feet grayish-blue; claws black; iris brown. Head and neck above rich dark brown, glossed with green and purple; side of neck with a long white stripe running up from the white under parts: back of neck with a black stripe passing below into the gray color of the back: the lower fore-neck, breast, and under parts usually, white, the sides finely waved with black, the crissum black, white-bordered. Fore back finely waved with narrow bars of black and white or whitish; the scapulars and long tertiaries firmly striped lengthwise with velvety-black and silvery-gray. Lesser wing-coverts plain gray; greater tipped with reddish buff, framing the speculum anteriorly; this is of coppery- or purplish-violet iridescence, framed posteriorly with black sub-tips and white tips of the secondaries, internally with silvery and

FIG. 480 — Pin-tail Duck, ♀ ♂. (From Lewis.)

black stripes. Tail-feathers gray, the long central ones blackish; sides and roots of tail varied with blackish and buff. It is thus a very handsome duck in full plumage, aside from the trim and clipper-like build. Length very variable, up to 30 inches, according to development of tail, which is sometimes 9 inches long, usually 5 or 6; extent 36.00; wing 11.00; bill 2.25; tarsus 1.67; middle toe and claw 2.25. Adult ♀: Smaller; lacking the development of the tail; length 24 *or less*. Only traces of the speculum, in green specks in a brown area between white or whitish tips of the secondaries and those of the greater coverts. Bill blackish; feet dull grayish-blue; iris brown. Whole head finely speckled, and whole neck finely streaked, with dusky-brown and grayish-brown or yellowish-brown; under parts pale ochrey-brown, freckled with dusky; upper parts variegated with brownish-black and yellowish-brown, on the fore parts the lighter color in angular or rounded bars on each feather. Young drake like the duck. Though the resemblance is close to some other species, observe color of bill and feet, tips of secondaries and greater coverts, and size and generic characters. Northern hemisphere; N. Am. at large, wintering and migrating in U. S. and beyond, breeding from northern borders northward; more numerous in the interior than along either coast. I have found it breeding abundantly in parts of N. Dakota and Montana. Nest on ground; eggs 6–10–12, smooth, elongated ellipsoidal, 2.10 to 2.30 long by about 1.52; uniform dull grayish-olive, without any buff tint.

286. **CHAULELASMUS.** (Gr. χαύλιος, *chaulios*, protuberant; ἔλασμός, *elasmos*, a layer, plate; referring to the teeth of the bill.) Gadwalls. Bill about as long as head, rather exceeding tarsus, the sides parallel to the rounded tip, the lamellæ not concealed, the nostrils high up near the base, the reëntrance between the feathers on culmen and those on side of bill short and open, in advance of feathers on side of lower mandible. Wings pointed, 1st primary longest. Tail short, rounded or cuneate, with pointed feathers. ♂ with most of the plumage barred or half-ringed with black and white, or whitish; middle wing-coverts *chestnut*, greater coverts *black*, *speculum white*; ♀ with similar *white* speculum. Feet yellowish.

711. **C. streperus.** (Lat. *streperus*, noisy, 'obstreperous.') Gadwall. Gray Duck. Adult ♂: Bill blue-black; feet dull orange, with dusky webs and claws; iris reddish-brown. Head and neck brownish-white, darker on crown and nape, barred and specked with dusky. Lower neck, breast, sides of body and fore-back waved with crescentic bars of blackish and white, the crescentic marks giving a scaly appearance most distinct on the neck and breast, elsewhere finer, more undulatory and transverse. Lower back dusky, passing to black on the rump and tail-coverts. Belly white, minutely marbled with gray. Scapulars tinged with rusty brown; longest inner quills hoary gray; lining of wings white; lesser upper coverts gray; middle coverts chestnut-red; speculum white, formed by part or the whole of the outer webs of the secondaries, framed in velvet black of the greater coverts, terminally bordered with black and hoary gray. Length about 22 inches; extent 34.00; wing 10.50–11.00; tail 4.50; tarsus 1.60; bill 1.75; middle toe and claw 2.20. Adult ♀: Smaller than ♂. Bill dusky, blotched with orange. Feet dingy yellowish, with dusky webs and claws. Lacking the regular crescentic and wavy markings of the ♂; variegated with dusky and tawny brown, like ♀ of other species; the chestnut of the ♂ wanting or restricted; but the wing-markings are sufficiently distinctive. Young drake resembling the ♀. One of the most widely diffused of ducks, in most parts of the world; in N. Am. nearly throughout, but not specially arctic in the breeding season, nesting anywhere in the U. S. Nest on ground, sometimes in trees; eggs creamy-buff, a trifle over 2.00 by about 1.50.

287. **MARECA.** (S. Am. *mareca*, Brazilian name of a kind of teal.) Wigeon. Bill shorter than head, rather high and narrow at base, parallel-sided, with rounded end, the nail occupying the middle third; the upper lateral reëntrance short and open; nostrils high up and near base. Tail pointed, of 16 feathers, not half as long as wing. Bill and feet dark colored; belly and middle and greater wing-coverts white; top of head white or light; speculum green, black-bordered.

Analysis of Species.

Head and neck cinnamon-red, scarcely varied; with mere traces of green, if any; top of head creamy or brownish-white . . . . . *penelope* 712

Head and neck grayish, speckled with dusky, the sides of the head with a broad patch of green, the top white or nearly so . . . . . *americana* 713

712. **M. pene'lope.** (*Penelope*, a mythological name.) EUROPEAN WIGEON. Size and general character of the next species; differing as above. Europe; Greenland; rare or casual along the whole Atlantic coast; more numerous on the N. Pacific coast and S. to California.

713. **M. america'na.** (Fig. 481.) AMERICAN WIGEON. BALD-PATE. Adult ♂: Bill grayish-blue, with black tip and extreme base; feet similar, duller, with dusky webs and claws; iris brown. Top of head white, or nearly so; sides the same, or more buffy, speckled with dusky-green, purer green forming a broad patch from and below eye to hind head; chin dusky. Fore neck and breast light brownish-red, or very pale purplish-cinnamon, each feather with paler grayish edge; along the sides of the body the same, finely waved with dusky; the breast and belly pure white, the crissum abruptly black. Lower hind neck and fore back and scapulars finely waved with the same reddish color and with dusky; lower back and rump similarly waved with dusky and whitish. Lesser wing-coverts plain gray; middle and greater coverts pure white, forming a large area, the greater black-tipped, forming the fore border of the speculum, which is glossy green, bordered behind by velvety black, internally by the black and white stripes on the inner secondaries. Tail brownish-gray, the lateral upper coverts black; axillary feathers white. Only old drakes have the crown immaculate white, the chin dusky, the auricular patch definitely green; generally the whole head and upper neck are pale brownish-yellow or reddish-white, speckled with greenish-dusky. ♀ resembling the immature ♂ on the head; the peculiar brownish-red is interrupted with dusky and whitish bars. The wing-pattern is nearly as in the ♂; but the white is restricted or interrupted with gray, the greater coverts may lack black tips, the speculum is faint, and the black stripes of the inner secondaries are replaced by brown. The normal variability in coloration, aside from age or sex, is great, but the bird cannot be mistaken under any conditions; the extensive white of the under parts and wings is recognizable at gun-shot range. Length 18.00–21.00; extent 30.00–35.00; wing 10.00–11.00; tail 4.00–4.50; bill 1.60; tarsus 1.50; middle toe and claw more. N. Am. at large, breeding anywhere; Europe, casually. Eggs 8–12, 2.00 × 1.50, dull pale buff.

FIG. 481. — American Wigeon. (From Lewis.)

288. **QUERQUE'DULA.** (Lat. *querquedula*, a small kind of duck: related to English *quack*.) TEAL DUCKS. Bill nearly or quite as long as the head, longer than tarsus, narrow and parallel-sided, the nail narrow, $\frac{1}{5}$ to $\frac{1}{3}$ of the tip. Size smallest among our ducks. Sexes more or less unlike. Speculum glossy-green. Bill blackish. The genus contains two sections, perhaps as worthy of distinction as some of the foregoing genera.

Analysis of Subgenera and Species.

NETTION. Head sub-crested. Bill very narrow; nail about ⅓ its tip. Reëntrance of feathers on sides of culmen in advance of base of bill below. Head and neck chestnut, with a broad glossy green band on each side behind eye, bordered with whitish, blackening where meeting on nape. Under parts white, with circular black spots; crissum black, varied with white or creamy; upper parts and sides of body closely waved with black and white. Speculum rich green bordered in front with buff tips of the coverts, behind with white tips of the secondaries; no blue on wing; feet dark; bill black. ♀ differing especially in the head markings, those of wings similar.

- No white on side of body in front of wing; long scapulars black externally, creamy white internally . . . . . *crecca* 714
- A white crescent on side of body before wing; scapulars plain . . . . . *carolinensis* 715

QUERQUEDULA proper. Head close-feathered. Bill broader than in *Nettium*, the nail about ⅓ its tip. Reëntrance on sides of culmen not in advance of base of bill below. Wing-coverts in ♂ ♀ sky blue, the greater white-tipped; scapulars of ♂ striped with blue and buff.

- ♂ Head and neck blackish-plumbeous; a large white crescent in front of eye . . . . . *discors* 716
- ♂ general color purplish-chestnut; no white on head . . . . . *cyanoptera* 717

714. Q. (N.) crec'ca. (Lat. *crecca*, formed like *crex*, crake, quack, etc., to express the sound.) EUROPEAN GREEN-WINGED TEAL. Like the next to be described: No white crescent before wing; green band in chestnut of side of head bordered with decided whitish; barring of sides and upper parts broader and coarser; long scapulars as well as inner secondaries creamy white, black-bordered externally. Europe; Greenland; casually on N. Am. Atlantic coast.

715. Q. (N.) carolinen'sis. (Fig. 482.) AMERICAN GREEN-WINGED TEAL. Adult ♂: Bill black; feet bluish-gray; iris brown. A white crescent in front of wing. Head and upper neck rich chestnut, blackening on chin, with a glossy green patch behind each eye blackening on its lower border and on the nape where it meets its fellow among the lengthened feathers of the parts, bordered below by a more or less evident whitish line, which may often be traced to the angle of the mouth. Upper parts and flanks waved with narrow black bars on a whitish ground. Under parts white, becoming buff or fawn-colored on breast, nebulated with gray, on the breast with numerous sharp circular black spots; fore neck and sides of breast waved like the upper parts. Crissum black, with a buff or creamy patch on each side. Primaries and wing-coverts leaden gray; speculum velvety purplish-black on outer half, the inner half rich green; bordered in front with chestnut, fawn or whitish tips of the greater coverts, behind by white tips of the secondaries, interiorly with purplish-black stripes on the outer webs of the lengthened secondaries. Adult ♀: Nearly like ♂ on the wings, the green speculum less perfect; no crest; head and neck streaked with light reddish-brown on a dark brown ground; upper parts mottled with dark brown, barred and streaked with tawny or grayish; lower parts white, more or less buffy-tinged on lower fore neck and breast, which have nebulous dusky spotting. A very small species, one of the most prettily colored of all, of unsurpassed excellence of flesh:

FIG. 482. — American Green-winged Teal. (From Lewis.)

length about 14.00; extent 23.00; wing 7.00–7.50; tail 3.00; bill 1.50; tarsus 1.20. N. Am. at large, extremely abundant; casual in Europe. Breeds from the N. borders of the U. S. It is one of the earliest arrivals among the hordes of water-fowl that come thronging from the north in fall. Nest on the ground, of weeds, grass, and feathers: eggs about 8, 1.75 to 1.90 by 1.20 to 1.30, pale dull greenish in color.

716. **Q. dis/cors.** (Lat. *discors*, discordant.) BLUE-WINGED TEAL. Adult ♂: Bill grayish-black; feet dingy yellow, with dusky webs and claws; iris brown. Head deep leaden-gray, with purplish gloss, blackening on top; a large white black-edged crescent in front of eye. Under parts purplish-gray, with innumerable black spots, rounded or oval on the breast, changing to bars on the flanks, becoming nebulous on the belly. Crissum black, a patch on each side of rump, the axillars and most of the lining of the wings, white. Lower hind neck and fore back varied with brownish-black and yellowish-brown; lower back and rump dark brown with a greenish tinge. Wing-coverts and outer webs of some of the scapulars sky-blue; speculum rich green, set between white tips of the greater coverts and secondaries, some of the inner secondaries and longest scapulars velvety greenish-black on outer web, greenish-brown on inner web, striped lengthwise with reddish-buff. ♀ retaining the sky-blue on the wing-coverts and much of the other wing-markings, hence easily distinguished among our ducks, excepting ♀ *cyanoptera*. Bill greenish-dusky; feet very pale or flesh-tinted. Head and neck streaked with brownish-black on a dull buff ground, the cheeks and chin whitish, unmarked. Above, dark brown, with pale edges of the feathers; below, whitish-gray, mottled with obscure spots. Length 15.00–16.00; extent 26.00–30.00; wing 7.00–7.50; tail 3.50; bill 1.50; tarsus 1.20. N. Am., chiefly E. of the R. Mts., to the Pacific in Alaska; goes to high latitudes, but also breeds indefinitely throughout its range; abundant in the U. S. in winter and during the migrations.

717. **Q. cyano/ptera.** (Gr. *κυανός, kuanos*, blue; *πτέρον, pteron*, wing.) CINNAMON TEAL. Adult ♂: Bill black; feet orange, joints and webs dusky; iris orange. Head, neck, and entire under parts rich purplish-chestnut, darkening on crown and chin, blackening on middle of belly; crissum dark brown. Fore back lighter cinnamon, varied with brown curved bars, several on each feather; lower back and rump greenish-brown, the feathers edged with paler. Wing-coverts sky-blue, as in *discors;* some of the scapulars blue on outer webs and with a central buff stripe, others dark green, with buff stripe. Speculum green, set between white tips of greater coverts and white ends of the secondaries. Wings thus quite as in *discors*, but the body-colors and head entirely different; rather larger; length 16.00–17.00; extent 25.00; wing 7.50–8.00; bill 1.60–1.75, along commissure about 2.00. Adult ♀: Similar to ♀ *discors*, and not easy to distinguish; larger; bill longer; under parts at least with a tinge of the peculiar chestnut color; head and especially chin more speckled, without the immaculate whitish of those parts of ♀ *discors*. Bill dusky, paler below and along edges; iris brown; feet yellowish-drab. A generally distributed S. Am. teal, now abundant in U. S. west of the R. Mts., and of casual occurrence in the Gulf States. Nest on ground, of grass and feathers, anywhere in its U. S. range; Colorado, Utah, Nevada, California, Idaho, Oregon, etc. Eggs 9–12, laid in June, oval, one end smaller than other, creamy white or pale buff; 1.90 × 1.30 to 2.10 × 1.40.

289. **SPA/TULA.** (Lat. *spatula* or *spathula*, a spoon, spathe, spatula: shape of the bill.) SPOON-BILL DUCKS. Bill much longer than head or tarsus, twice as wide at end as at base, broadly rounded spoon-fashion at end; the nail narrow and prominent, the laminæ very numerous and protrusive. Tail short, pointed, of fourteen acute feathers. Feet small, red. The peculiarity of the bill characterizes this genus almost as strongly as *Platalea* among ibises, or *Eurynorhynchus* among sandpipers; the form is otherwise that of ordinary *Anatinæ*. There are several species, one N. American.

718. **S. clypea/ta.** (Lat. *clypeum*, a shield: shape of the bill. Fig. 483.) SHOVELLER DUCK.

Broad-bill. Adult ♂: Bill blackish; iris orange-red; feet vermillion-red. Head and neck dark glossy green. Lower neck and fore breast pure white. Abdomen purplish-chestnut. Wing-coverts sky-blue; speculum rich green, set between white tips of greater coverts, and black subtips and white tips of secondaries; inner secondaries greenish-black, with long white stripe; long scapulars blue on outer webs, striped with white and greenish-black on inner; short anterior scapulars white. Rump and upper and under tail-coverts black; a white patch on each side at root of tail. Adult ♀: Bill dull greenish; iris yellow; feet orange. Wing-markings similar to those of ♂, though imperfect; traces of chestnut on belly. Head and neck brownish-yellow, speckled with dusky. In any plumage the species is of course at once recognized by the peculiar bill. Length 17.00–21.00; extent 30.00–33.00; wing 9.50; tail 3.00; bill about 2.70; along commissure 3.00; tarsus 1.33. Europe, Asia, etc.; in N. Am. at large, breeding throughout, and wintering in abundance from the middle districts to C. Am..

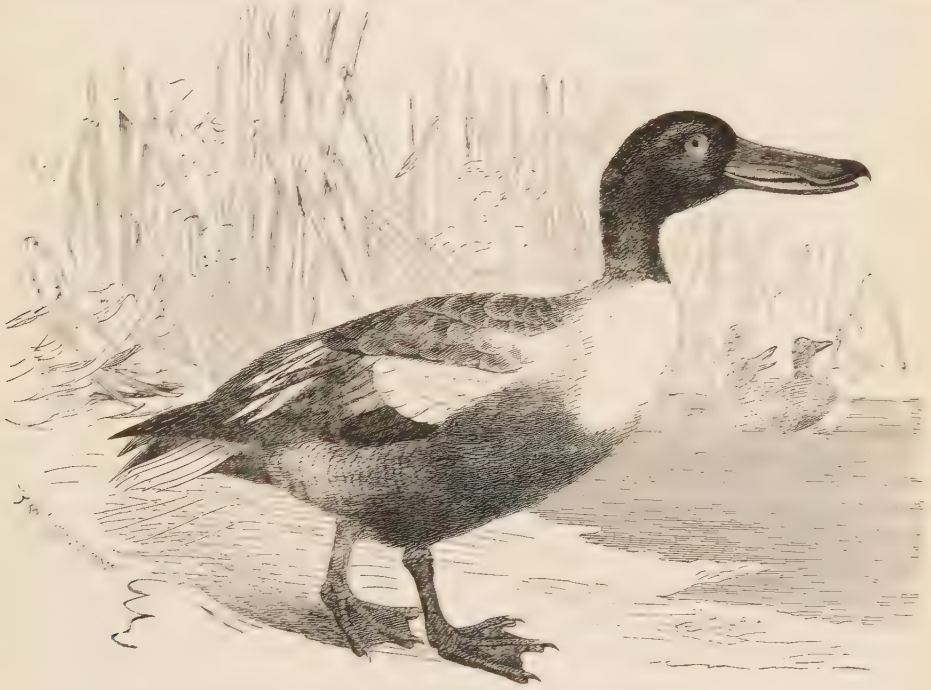


Fig. 483. — Shoveller Duck, ¼ nat. size. From Brehm.

Eggs about 8, averaging 2.10 × 1.50, smooth, elliptical, in color dull pale greenish-gray, sometimes faintly bluish. In full dress, which is comparatively infrequent, since it characterizes only the breeding season, this is a very smart and jaunty drake, tricked out in parti-color; the great majority of specimens, however, are found in a plumage more like that of the duck. The bird is among the best of the ducks for the table.

290. **AIX.** (Gr. *αἴξ* or *ἄιξ*. *aix* or *aïx*; application not obvious.) Bridal Ducks. Head crested. Bill shorter than head, no longer than tarsus, very high at base, the reëntrances at sides of culmen much prolonged towards the forehead. Nostrils large, oval, set little in advance of the feathers on culmen. Terminal nail occupying the whole end of the bill, and much curved downward. Lamellæ small, few, and distant. Tarsus incompletely scutellate in front, much shorter than middle toe. Claws compressed, curved, and acute, that of the middle toe dilated on inner edge. Tail half as long as wings, rounded, of sixteen rounded feathers, and very

long coverts. A peculiar as well as most beautiful genus; the Chinese Mandarin Duck, *A galericulata*, is still more remarkably, though not more elegantly, colored than ours.

*19. **A. spon'sa.** (Lat. *sponsa*, betrothed: i. e., as if in wedding dress. Fig. 484.) WOOD DUCK. SUMMER DUCK. "THE BRIDE." Adult ♂: Bill pinkish-white, with lake-red base, black ridge, tip, and under mandible; iris and edges of eyelids red; feet orange, with black claws. Upper part of the head, including crest, glistening green and purple; a narrow white line over eye from bill to occiput, and another behind eye to nape, these white lines mixing in the crest. A broad white patch on the throat, forking behind, one branch mounting head behind eye, the other passing to side of neck. Sides and front of lower neck and fore breast rich purplish-chestnut, prettily marked with several chains of angular white spots. A large white black-edged crescent of enlarged feathers in front of the wing. Under parts pure white, the sides yellowish-gray vermiculated with black and white wavy bars; the enlarged flank-feathers broadly rayed with black and white; the lining of the wings white barred with grayish-brown, of which color is the crissum. Upper parts generally lustrous with bronzy-green and purple; scapulars and inner secondaries velvet-black, glossed with purple and green; a green speculum, succeeded by white tips of the secondaries; primaries frosted on outer webs near end. Adult ♀: Little or no crest, but lengthened feathers on nape; no enlargement or special colorings of feathers about the wings. Bill dusky: feet yellowish-dusky. Head and neck gray, darker on crown, the chin and parts about bill and eyes white. Fore neck, breast and sides of body yellowish-brown, mottled with dark gray, the breast spotted with brown, the belly white. Upper parts dark brown with considerable gloss; wings much as in the male, but the velvety-black reduced. Length 18.00–20.00; extent about 28.00; wing 9.00; tail 4.50; bill 1.40; tarsus the same; middle toe and claw 2.00. N. Am. at large, but especially U. S., breeding throughout its range, wintering chiefly in the South. This exquisite bird is commonly dispersed in wooded portions of the country near water; it nestles usually in the hollows of trees, whence the young are transported in the bill of the parent. Eggs about a dozen, very variable in number, of pale drab color and the usual smooth shell and elliptical shape, about 2.00 × 1.50.

FIG. 484. — Wood Duck. (From Tenney, after Audubon.)

68. Subfamily FULIGULINÆ: Sea Ducks.

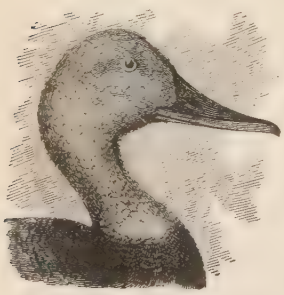


FIG. 485. — Canvas-back. (From Lewis.)

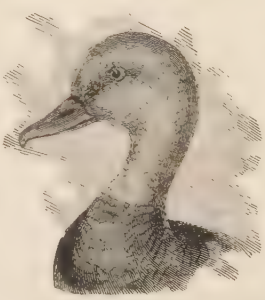


FIG. 486. — Red-head. (From Lewis.)

Tarsi scutellate in front; hind toe lobate. The large membranous flap depending from the hind toe distinguishes this group from the preceding, probably without exception. While the general form is the same as that of the *Anatinæ*, the feet are notably larger, with relatively shorter tarsi, longer toes (the outer scarcely or not shorter than the middle), and broader webs; they are also placed somewhat further back,

in consequence of which the gait is still more awkward and constrained than the "waddle" of ordinary ducks; but swimming powers are enhanced, and diving is facilitated. A large number of the species are exclusively maritime, but this is no more the case with all of them, than is the reverse with the river ducks. These birds feed more upon mollusks and other animal substances (not, however, upon fish, like the mergansers) than the river ducks do, and their flesh, as a rule, is coarser, if not entirely too rank to be eaten; there are, however, signal exceptions to this, as in the case of the canvas-back. The sexes are unlike, as among the *Anatinæ;* and besides the difference in color, the ♀ is often distinguished by the absence or slight development of certain tuberosities of the bill that the ♂ of several species, as of scoters and eiders, possesses. A large majority of the species inhabit the Northern Hemisphere; there are some forty in all, exhibiting a good deal of diversity in minor details, really requiring recognition of many genera. Among notable exotics, we have the soft-billed *Hymenolæmus malacorhynchus* of New Zealand, and the short-winged *Micropterus cinereus* of South America, both related to our genus *Camptolæmus;* there are but few others. The genus *Erismatura* is the type of a small group remarkable for the character of the tail, as described beyond, and sometimes considered as a subfamily apart. *Biziura lobata* of Australia, with a fleshy appendage under the bill, the African *Thalassornis leuconota*, the *Nesonetta aucklandica*, and several species of *Erismatura* and *Nomonyx*, compose this group.

Analysis of Genera and Subgenera.

Tail-feathers rigid, narrow, linear, exposed to their bases by shortness of coverts.
- Nail of bill ordinary . . . . . *Nomonyx* 299
- Nail of bill narrow above, overhanging and widened beneath tip of bill . . . . . *Erismatura* 298

Tail-feathers and their coverts ordinary (central pair very long, however, in *Harelda* ♂).
- Bill variously gibbous, or appendaged, or feathered beyond nostrils.
  - Bill gibbous at base, then broad, depressed, with large fused nail, without frontal processes.
    - Gibbosity of bill superior, circumscribed; feathers not projected on culmen. Tail 16-feathered. ♂: Color entirely black (ŒDEMIA) . . . . . *Œdemia* 297
    - Gibbosity of bill superior, circumscribed; feathers projected on culmen. Tail 14-feathered. ♂: Color black or dark, with white wing-patch (MELANETTA) . . *Œdemia* 297
    - Gibbosity lateral as well as superior; feathers projected on culmen. Tail 14-feathered. ♂: Color black, with white head-patches (PELIONETTA) . *Œdemia* 297
  - Bill gibbous at base, with large frontal processes.
    - Frontal processes in line with culmen (SOMATERIA proper) . . . . . *Somateria* 296
    - Frontal processes bulging out of line with culmen (ERIONETTA) . . . . . *Somateria* 296
    - Bill not gibbous, but feathered on culmen beyond nostrils (ARCTONETTA) . . . . *Somateria* 296
    - Bill not gibbous, but appendaged with leathery expansion of side of upper mandible, cheeks not bristly (HENICONETTA) . . . . . *Somateria* 296
  - Bill not gibbous, but appendaged with a lobe at base of commissure . . . . . *Histrionicus* 295
  - Bill not gibbous, but appendaged with a leathery expansion of side of upper mandible; cheeks bristly . . . . . *Camptolæmus* 294
- Bill ordinary.
  - Nail of bill large, fused. Tail (of ♂) about as long as wing . . . . . *Harelda* 293
  - Nail of bill narrow, distinct. Tail of ordinary length and shape.
    - Bill shorter than head, high at base. Head of ♂ puffy or crested, iridescent, with white patches; crissum white; colors black and white, in masses . . . . . *Clangula* 292
    - ♂, white spot before eye (CLANGULA proper) . . . . . *Clangula* 292
    - ♂, white patch behind eye (BUCEPHALA) . . . . . *Clangula* 292
    - Bill about as long as head. Head of ♂ black, red, or brown, without spots; crissum dark . . . . . *Fuligula* 291
    - Bill dusky. Head of ♂ dusky reddish (ARISTONETTA) . . . . . *Fuligula* 291
    - Bill bluish or blackish. Head of ♂ black or red. (FULIX) . . . . . *Fuligula* 291
    - Bill red. Head red, crested (European). (FULIGULA proper) . . . . . *Fuligula* 291

NOTE. — See further analyses of the subgenera (some of which are of generic value) under heads of *Œdemia*, *Somateria*, and *Fuligula*.

291. FULIGULA. (Lat. *fuligula* or *fulicula*, dim. of *fulix* or *fulica*, a coot; *fuligo*, soot.) BLACK-HEAD and RED-HEAD DUCKS. SCAUPS and POCHARDS. Bill ordinary, without special gibbosity or peculiar outline of feathers at base, only in one species (*F. vallisneria*)

not shorter than head and rising high on forehead; nail at end distinct, decurved, narrow, less than one-third as wide as end of bill; frontal feathers extending to approximately equal distances on top and sides of upper mandible, with a well-marked reëntrance between them reaching back to about opposite angle of the mouth, those of chin advancing rather farther. Nostrils in basal two-fifths of bill (nearly median in *F. vallisneria*). Outline of upper mandible gently concave to the decurved nail; sides nearly parallel, or widening toward end (whole bill much as in ordinary *Anatinæ*). Tail short, rounded, less than half as long as wing, 14–16-feathered. Tarsus less than $\frac{2}{3}$ ($\frac{1}{2}$–$\frac{2}{5}$) as long as middle toe and claw. Head not crested or notably puffy (in our species). Head and neck black, brown or chestnut (not green with great white patches). Sides and back finely waved with black and white. Lining of wings white. Crissum black. Bill blackish, or black and blue. Legs dark. Speculum white or gray. (Comprising several species of "black-head" and "red-head" ducks, including the "canvas-back"; characters drawn up on consideration of these species; requiring modification, especially as to color, to include the European *F. rufina*, by some considered type of the genus. Equivalent to *Fulix*, *Aythya* and *Aristonetta* of Baird, 1858, and apparently separable into three full genera — one for the crested pochards of Europe; one for the black-heads and red-heads together; and one for the canvas-back alone. The type of *Fuligula* is said by Sundevall to be *F. cristata;* in which case *Callichen* is available for *rufina*.)

Analysis of Species.

Conspicuously crested; bill and feet red (*Fuligula*) . . . . . *rufina* 886
Not crested; bill and feet dark.
  Bill not longer than head, with concave line of culmen, not notably high on forehead; chord of culmen under 2 inches. Nostrils fairly in basal half of bill. (*Fulix.*)
    Black-heads: ♂ with head, neck, body anteriorly, lower back, rump, tail and its coverts, black, the head glossy; below, including lining of wings, white, with fine black waving on sides and lower belly; bill black and blue, or dusky; feet dark. ♀ with head and neck brown, with or without white around bill, and other black parts of ♂ rather brown. (*Fulix* proper.)
      No ring around neck.
        ♂ Speculum white; back and sides finely waved in zig-zag with black and whitish; bill blue, with black nail. ♀ with the face white.
          Length about 20.00; wing 9.00; gloss of head green . . . . . *marila* 720
          Length about 16.00; wing 8.00; gloss of head purple . . . . . *affinis* 721
      An orange-brown ring round neck of ♂.
        Speculum gray; back nearly uniform blackish; bill black, pale at base and near end; ♀ without collar; lores and chin whitish, and ring round eye . . . . . *collaris* 722
    Red-heads: ♂ with head and neck chestnut, in ♀ plain brown; body anteriorly, rump, tail, and its coverts, black, in ♀ brown; back, scapulars, and sides finely waved with black and white or ashy-white in equal amounts; speculum gray. Bill blue with black belt at end. Back distinctly vermiculated with black on an ashy-white ground (*Æthyia*) . . . . . *americana* 723
  Bill longer than head, with scarcely concave culmen rising high on forehead; chord of culmen over 2 inches. Nostrils reaching middle of bill.
    Canvas-back: ♂ head dark chestnut-brown, much obscured with dusky on top and about bill. Silvery-whitish of back prevailing over the black waved lines, which are narrow and much broken into chains of dots (*Aristonetta*) . . . . . *vallisneria* 724

Fuligula.

886. (addenda.) **F. rufi'na.** (Lat. *rufina*, reddish.) Red-crested Pochard. Adult ♂: Conspicuously crested. Bill vermilion, white-tipped; feet orange-red; eyes brown. Head and upper neck rusty-red, with a rosy tint. Lower- and hind-neck, fore-back, breast, and middle of belly black. Back grayish-brown, with a large white patch on each side, blackening on rump and upper tail-coverts. Tail ashy-gray. Primaries whitish, edged and tipped with dusky-gray; speculum and sides of belly white. ♀: Bill dusky with pink tip, and feet pinkish, with dusky webs. Upper parts generally rufous-brown, under parts brownish-white, the throat and upper fore-neck whitish; crown and rump darker than other upper parts, the dorsal feathers with pale edges; quills brown, edged and tipped with darker, the

speculum gray, bounded terminally with brown. Europe, etc. One found in Fulton Market, New York, Feb. 1872. (See Check List, 2d ed., 1882, p. 136.)

FULIX.

720. F. mari'la. (Qu. proper name? Qu. Gr. *μαρίλη, marile,* charcoal, from the pitch-black fore-parts?) GREATER SCAUP DUCK. BIG BLACK-HEAD. BLUE-BILL. RAFT DUCK. FLOCKING FOWL. SHUFFLER. Adult ♂: No ring around neck. Speculum white. Bill dull blue, with black hooked nail, broad and flat at end, where considerably wider than at base. Iris yellow. Feet livid blackish, or dark plumbeous, with darker webs. Whole head, neck, and fore-parts of body pitch-black, on the head with chiefly green iridescence. Lower back, rump, tail, with both upper and under coverts, black or blackish. Middle of back, scapulars, and most of under parts, white, the interscapulars, scapulars, sides of body, flanks, and lower belly waved with fine zig-zag cross-lines of black, quite in "canvas-back" style. Wing-coverts similar to back, but darker gray and more obscurely marked; the greater coverts tipped with black, forming the anterior border of the white speculum, which is formed by the secondaries, the white extending quite across them, their tips black. Primaries brownish-black, becoming gray inwardly. Axillars and most of under wing-coverts white. ♀: Bill, eyes and feet as before. The black parts of the ♂ replaced by dusky or dark brown, which latter is the color of the head. A broad belt of pure white around base of upper mandible, forming a conspicuous white "face." The black-and-white vermiculation less distinctly developed. Length of ♂ ♀ 18.00–20.00; extent 30.00–35.00, usually over 30.00; wing 8.50–9.00; tail 3.00; bill 2.00; tarsus 1.50; middle toe and claw 2.60. Europe, Asia, etc., and N. Am. at large; on the whole more northerly than *F. affinis*, not proceeding so far south in winter, though breeding no farther north — from N. borders of U. S., northward. The more frequent U. S. scaup in winter is *F. affinis*. Nest on ground, down-lined; eggs drab-colored, 2.45 × 1.72.

721. F. affi'nis. (Lat. *affinis, ad* and *finis*, allied, affined.) LESSER SCAUP DUCK. LITTLE BLACK-HEAD (with other names of the foregoing). Extremely similar to the last; gloss of head chiefly purple, sides and flanks less closely waved with black? Smaller: length 15.50–17.00; extent under 30.00; wing 8.00 or less; tail 2.50; bill 1.75; tarsus 1.50; middle toe and claw 2.30. It is difficult to define this bird specifically, but it appears to preserve its characters, though constantly associated with the last. N. Am. at large; breeds from the N. borders of the U. S. northward; winters in and migrates through the U. S. to C. Am. and W. I.

722. F. colla'ris. (Lat. *collaris*, pertaining to *collum*, the neck: collared.) RING-NECK DUCK. Adult ♂: A chestnut or orange-brown ring round neck. Speculum gray (not white). Bill black, the base and edges, and a belt near end of upper mandible, pale bluish. Iris yellow. Feet grayish-blue, with dusky webs. Head and neck above the collar lustrous black, with green, violet, and purple iridescence, the extreme chin white. Lower neck, fore-breast, upper parts generally, blackish, the scapulars scarcely waved or only dotted with grayish. Crissum black; under parts generally, including lining of wings, white, the lower belly and sides finely waved with black. Wings plain dark brown, with an ashy-gray speculum formed by outer webs of some of the secondaries. Tail of 16 feathers. Adult ♀: No collar; head umber-brown darker on top, with whitish cheeks and chin, and white eye-ring; other black parts of ♂ dark brownish; under parts less extensively and less purely white; wing and its speculum as before. Length 16.00–18.00; extent 30.00 or less; wing abont 8.00; tail 2.75; tarsus 1.25; bill 1.75, not so much widened at end as that of the scaups. N. Am. at large; breeds from N. border of U. S. to far north, winters in and migrates through U. S. to C. Am. and W. I. Nest on ground, of grass and moss; eggs about 9, pale greenish. 2.25 × 1.60.

723. F. feri'na america'na. (Lat. *ferina*, feral, wild. Figs. 486, 487, 488.) **Red-head.** American Pochard. Adult ♂: The feathers of the head somewhat full and puffy, though forming no crest. Bill broad and flattened, a little widened toward end, running into the forehead which arches abruptly over and away from it, not rising gradually into line with forehead; shorter or not longer than head, 2 inches or less in length along culmen, the nostrils within its basal half: the forward end of nostril about ⅔ the way from upper corner to end of bill. Bill dull blue with a black belt at the end. (Compare head and bill of canvas-back.) Iris orange. Feet dull grayish-blue, with dusky webs and black claws. Head and neck all around rich pure chestnut, not obscured with dusky-brown, but with bronzy or coppery red reflections. Lower neck and fore parts of body above and below, with rump and tail-coverts above and below, blackish. Back mixed whitish and blackish in about equal amounts, the dark wavy lines distinct and unbroken. (In the European pochard, *F. ferina*, from which our bird differs, the back is also distinctly and completely waved with black, but the ground is quite white, as in our canvas-back, in which the dark lines are much broken up, the white thus prevailing. This fine vermiculation, when not too closely examined, gives a delicate silvery-gray tone, of different shade in the different species.) Sides of body under the wings vermiculated much like the back, the undulations subsiding in the grayish-white of the middle under parts. Wing-coverts ashy-gray, minutely dotted with white; speculum hoary-ash, bordered internally with black; lining of wings mostly white. ♀: Bill obscured bluish, with black belt near end; iris yellow; feet as in ♂. Same shape of bill and head. Head and upper neck dull reddish-brown, paler or whitish on cheeks and behind eye; upper parts brownish, the feathers paler edged. Wings much as in ♂, the white lining restricted. Length 20.00–23.00; extent about 33.00; wing 9.00–10.00; tail 3.00, of 14 feathers; tarsus 1.50; middle toe and claw 2.75. N. Am. at large, but particularly

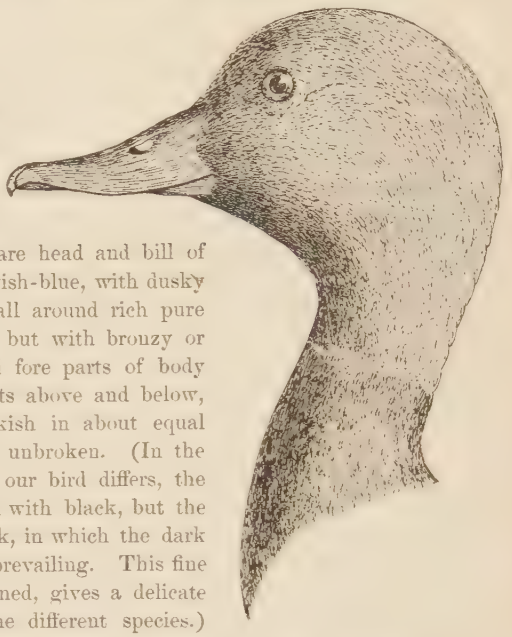


Fig. 487. — Red-head, ½ nat. size. (From nature by J. L. Ridgway.)

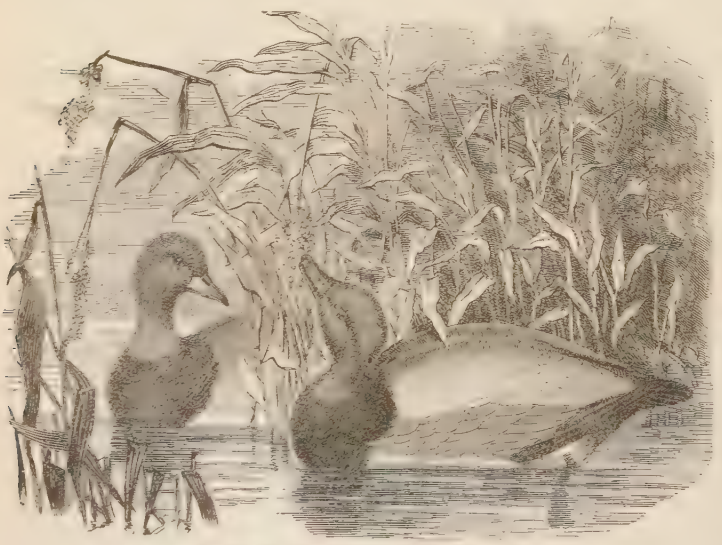


Fig. 488. — Red-heads. (From Lewis.)

E. of the Mississippi and along Atlantic Coast; breeds in high latitudes, winters in U. S. One of the commonest market-ducks in eastern cities in winter, selling readily for canvas-back, and more likely to be distinguished therefrom with the feathers on than off! Nest on ground, or among reeds over water like a coot's, down-lined. Eggs 7–8, buff, 2.25 × 1.70.

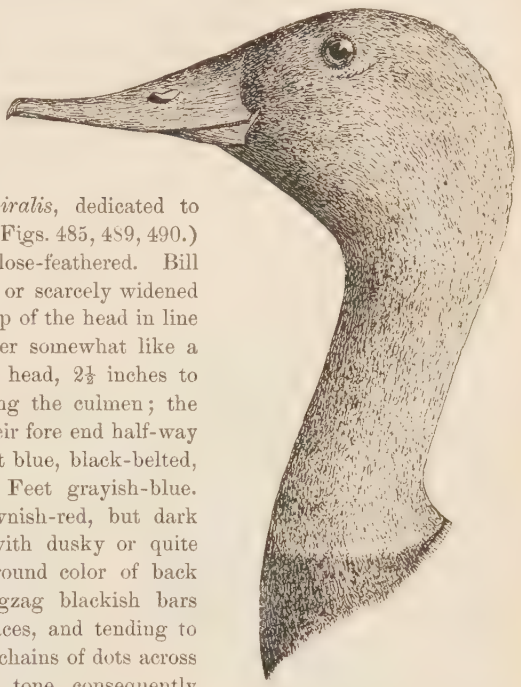


FIG. 489. — Canvas-back, ½ nat. size (From nature by J. L. Ridgway.)

ARISTONETTA.

724. F. vallisne'ria. (Name of a genus of aquatic plants, the wild celery, *V. spiralis*, dedicated to Antonio Vallisneri, an Italian naturalist. Figs. 485, 489, 490.) CANVAS-BACK. Adult ♂: The head close-feathered. Bill high at the base and narrow throughout or scarcely widened toward end, sloping gradually up to the top of the head in line with the sweep of the forehead, altogether somewhat like a goose's in shape; decidedly longer than head, 2½ inches to nearly or quite 3 in length, measured along the culmen; the nostrils reaching the middle of the bill, their fore end half-way from upper corner to end of bill. Bill not blue, black-belted, but blackish throughout. Eyes red. Feet grayish-blue. Head and upper neck not coppery brownish-red, but dark reddish-brown, further much obscured with dusky or quite blackish about the bill and on top. Ground color of back white, very finely vermiculated with zigzag blackish bars much narrower than the intervening spaces, and tending to break up, or mostly broken up, into little chains of dots across the feathers; the resulting silvery-gray tone consequently several shades lighter than in the red-head. Other characters substantially as in that species. ♀ differs as ♀ red-head does; head dark snuffy-brown, etc., but the bill is colored as in the ♂, and sufficiently preserves its peculiar shape; eyes reddish-brown. Size of the red-head, or a little larger; tarsus 1.75; bill longer, as above; culmen much over 2 inches; gape about 2.67; line from upper corner to tip nearly or quite 3.00, of which distance the nostrils reach half way. N. Am. at large; breeds from the northern tier of States northward, in the R. Mts. further south, and in upper California; winters in the U. S. and south-

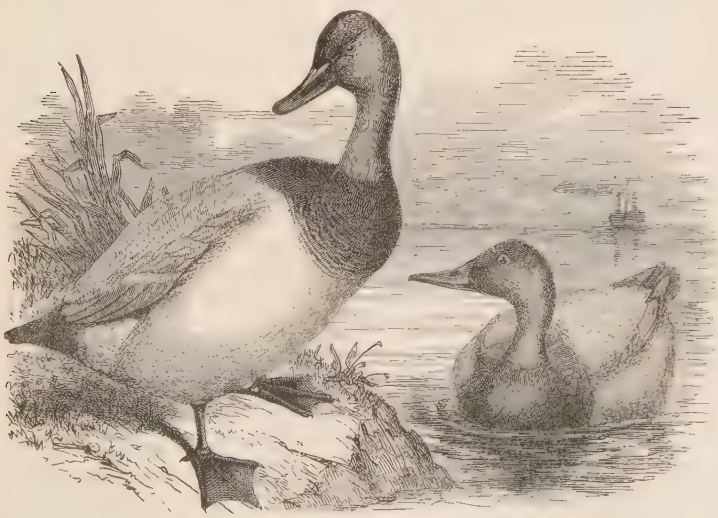


FIG. 490. — Canvas-back. (From Lewis.)

ward to Guatemala; abundant along the Atlantic coast, from the middle districts to Texas, especially in the Chesapeake. When feeding on the wild celery the flesh acquires a peculiarly fine flavor, which has gained for the bird great renown among gastronomers; but its flesh is of no special excellence under other circumstances, in fact inferior to that of most River Ducks (*Anatinæ*). There is little reason for squealing in barbaric joy over this over-rated and generally under-done bird; not one person in ten thousand can tell it from any other duck on the table, and then only under the celery circumstance just said.

292. CLAN'GULA. (Lat. *clangula*, dim. of *clangor*, a noise.) WHISTLERS. GARROTS. Bill much shorter than head, about as long as tarsus, very high at base, tapering to end with definite nail, and acute upper corners; frontal and mental feathers little in advance of loral. Nostrils median. Tail about half as long as wing, 16-feathered, pointed. Body plump; neck short; feet far back. ♂ with the head puffy or slightly crested, dark-colored, iridescent, with great white patches; lower neck all around, under parts including sides, and most of the wing-coverts, scapulars, and secondaries, white; lining of wings dark; most of upper parts black; no waving on back or sides; crissum not black; bill dark; feet light or bright. ♀ with less puffy dark brown or gray head, and traces or not of the white patches. Medium-sized and small ducks, mostly black and white. They include two types of at least subgeneric value; one (*Clangula* proper) represented by the garrots, the other (*Bucephala*) by the buffle-head.

Analysis of Species.

Nostrils rather before middle of bill. ♂ head uniformly puffy, the gloss green; a round or oval white spot before eye, not reaching upper corner of bill; white of wings continuous; lining of wings entirely dark; eye yellow; feet orange. ♀ head dark brown, unmarked. (*Clangula*) . . . . . *glaucium* 725

Nostrils as before. ♂ head somewhat crested, the gloss purple and violet; an angular or crescentic white space before eye, applied against whole base of bill; white of wings divided by a dark line; lining of wings entirely dark; eye yellow; feet orange. ♀ head dark brown, unmarked . . . . . *islandica* 726

Nostrils rather behind middle of bill. ♂ head extremely puffy, the gloss various. No white before eye, but great white space on side of head behind, meeting its fellow on nape; white of wing continuous; lining of wing with some white; eye brown; feet flesh-color; ♀ head dark gray, with trace of the white auricular patch. (*Bucephala*) . . . . . *albeola* 727

725. C. glau'cium. (Gr. γλαυκίον, *glaukion*; Lat. *glaucium*, a duck, perhaps this one.) GOLDEN-EYE. WHISTLER. GARROT. Bill with nostrils rather before than behind its middle line. Head moderately uniformly puffy. Adult ♂: Gloss of head chiefly green. A large round or oval spot before eye, not touching base of bill throughout; no white behind eye. Bill black, or greenish-dusky. Iris golden-yellow. Feet orange, with dusky webs and black claws. Lower neck, under parts at large, middle and greater wing-coverts, many secondaries, and shorter scapulars in part, white, that of the wings perfectly continuous. Shorter scapulars in part, long scapulars, inner and outer secondaries, edge of wing, primary coverts, primaries, and back at large, black, the latter glossy. Lining of wings dusky, as are some feathers at insertion of legs and on sides of rump. The white greater coverts have dark bases, not extensive enough, however, to divide the white wing-surface. ♀: Bill, eyes, and feet as in ♂, but former usually varied with yellowish at end. Head less puffy, snuffy-brown, without white loral space. Black parts of ♂ inclining to brownish; white of wings less extensive and complete, often waved with gray tips of some of the coverts; white of under parts often waved with gray or brown on lower neck and along sides. Length 17.00–20.00; extent 27.00–32.00; wing 8.00–9.00; tail 3.00–4.00; tarsus 1.30–1.50; middle toe and claw 2.50; bill 1.30 along culmen, about 2.00 along gape. ♀ smaller than ♂. Europe, etc.; N. Am. at large, a common winter duck of the U. S., breeding chiefly in high latitudes, but also in U. S. An expert diver. Meat bad — rank and fishy. Nest in trees.

726. C. islan'dica. (Of Ísland or Iceland.) BARROW'S GOLDEN-EYE. ROCKY MOUNTAIN GARROT. Very similar to the last. Bill with nostrils as before. Head moderately puffy, and with lengthening of coronal and occipital feathers into a slight crest. Gloss of head

chiefly purple and violet. A large triangular or crescentic white spot before eye, running up in a point, applied against the whole side of base of bill. White area on wing more or less divided by a dark bar resulting from extension of the dark bases of the greater coverts. Averaging larger than the last; length 19.00–22.50; extent 30.00 or more; wing 9.00–10.00; tarsus 1.60; bill as before, thus relatively shorter. Europe, Iceland; Greenland; N. Am., northerly; in winter S. to N. Y. and Utah; breeds in the R. Mts. of U. S. and in high latitudes. Not common with us. Seems well distinguished from *C. glaucium*, though the ♀ is not easily discriminated. It may usually be recognized by the occipital crest, the division of the white area on the wing, and the extensively parti-colored bill, which is blotched with reddish.

727. **C. albe'ola.** (Lat. *albeola* or *albula*, dim. of *albus*, white. Fig. 491.) BUFFLE-HEAD. BUTTER-BALL. SPIRIT-DUCK. DIPPER. Bill with nostrils rather behind than before its middle line. Adult ♂: Head particularly puffy with much lengthened feathers of lateral and hind parts, splendidly various with purple-violet and green iridescence; a large snowy patch on each side behind eye, blending on nape with its fellow. Bill dull bluish with dusky nail and base. Eyes brown. Feet pale flesh-color, with blackish claws. Upper parts at large black, fading to grayish-white posteriorly. Lower neck all around, under parts at large, scapulars in part, nearly all the wing-coverts, and most of the secondaries, white. Outer scapulars white, edged with black; inner secondaries velvet-black; sides and sometimes across lower belly shaded with dusky; lining of wings mixed dusky and white. ♀ much smaller than ♂; head scarcely puffy, but a thin compressed nuchal elongation of the feathers; dusky gray, with trace at least of the white space of the ♂, and commonly a white touch under eye. Bill dusky; feet livid bluish-gray, with dusky webs. Above at large dusky-gray or blackish, with white speculum on outer webs only of five or six secondaries; below white, shaded into dark along sides and across fore-breast and lower belly. Thus a very small insignificant-looking duck, but easily recognized on that very score; notice flap of hind toe, livid feet, dark bill, white spot on dark head behind eye, etc. Length of ♂ ♀ 12.75–15.00; extent 22.00–25.00; wing 6.00–7.00; tarsus 1.10–1.24; middle toe and claw 2.00–2.25; bill 1.00, along gape 1.40. ♀ at or about the lesser of these dimensions. N. Am. at large, and casual in Europe; U. S. in winter, one of the most abundant ducks; breeds from N. border of U. S. to high latitudes. The drake in full feather is one of the handsomest ducks, dressed in broad black and white in artistic contrast, to say nothing of the brilliancy of the head. Noted for its adroitness in diving to escape a shot, as smartly as a grebe, and on that account known in some of our elegant vernacular as "hell-diver." The flesh is little esteemed, so it is just as well there is so little of it. Nest feathery, in a tree; eggs up to 14,

FIG. 491.—Buffle-head (From Lewis.)

ellipsoidal, about 2.00 × 1.50, in tint buffy-drab (between grayish-olive and rich creamy-white.)

293. **HARELDA.** (The Icelandic name.) LONG-TAIL DUCK. Bill shorter than head, about as long as tarsus, high at base, nearly parallel-sided to the rounded end occupied by the broad nail; the upper lateral angles of most ducks obsolete, the feathers sweeping obliquely downward from those on culmen; those of chin reaching about opposite nostrils, which are placed high up in basal half of bill; the commissure ascending near end, then decurved into the prominent nail. Tail of 14 feathers, in ♂ as long as wing by excessive elongation of the narrow middle feathers (more so than in *Dafila* of *Anatinæ*): ♂ scapulars also long lanceolinear, produced straight over the wing. Sexual and seasonal plumages unlike. Crissum white; no white on wing nor any speculum; coloration chiefly black, white, and brown, with reddish on back in summer.

728. **H. glacialis.** (Lat. *glacialis*, icy.) LONG-TAILED DUCK. SOUTH-SOUTHERLY. OLD-WIFE. OLD-SQUAW. ♂, in breeding dress: Bill black, broadly orange toward end; iris carmine; feet livid bluish, with dusky webs and black claws. Head on top and behind blackish, with a great patch of silvery-gray, whitening around and behind eye. Neck all around and fore breast, very dark chocolate-brown, almost blackish; quills and lining of wings the same; under parts from the breast abruptly white. Upper parts at large, and long tail-feathers, blackish, the long scapulars varied with bright reddish; the shorter tail-feathers whitish, the lateral wholly so, the intermediate ones in part dark. Length very variable, according to development of the tail, up to 23 inches; middle tail-feathers up to 8 or 9 inches long, the lateral only about 2.50; wing 8.50–9.50; extent 30.00; bill 1.25; tarsus the same; middle toe and claw twice as much. Adult ♂, in winter: No reddish on upper parts; the scapulars pearly-gray. Head, neck, and fore back white or whitish, with gray cheek-patch, and dark brown or blackish patch below ear. Fore breast of the latter color, set squarely between white of neck and belly. Upper parts except as said, and four middle tail-feathers (less developed than in summer) blackish; the rest white. Bill extensively orange, with nail and broad saddle on mandible black. Young ♂ in first winter with bill and feet dusky. Adult ♀: No elongation of tail or scapulars; length about 18.00; extent under 30.00; wing 8.00–9.00; tail about 3.00. Bill and feet dusky-greenish; iris yellow. Head, neck, and upper parts dark grayish-brown, paler on throat, with large grayish-white patch around eye and another on side of neck; under parts white, shaded along the sides. Thus an obscure medium-sized duck; notice generic characteristics of bill, 14 tail-feathers, no white on wing, gray head and neck-patches in dark surroundings. N. Hemisphere, northerly, especially maritime; also on large inland waters; U. S. in winter only, breeding in high latitudes. A lively voluble duck, called by Sundevall melodious: "*Anas canora, ob cantum vernalem suavem et sonorum*"; an expert diver, rank animal feeder; meat bad. Nest on ground; eggs 6–7, smooth, drab-colored. 2.20 × 1.50, to 1.90 × 1.40.

294. **CAMPTOLÆMUS.** (Gr. καμπτός, *kamptos*, flexible; λαιμός, *laimos*, throat; referring to the leathery expansion of the bill.) PIED DUCK. Bill nearly as long as head, longer than tarsus, not higher than broad at the base, nearly parallel-sided, but widened toward end by a leathery expansion of edge of upper mandible, the nail distinct. Teeth of upper mandible slight, oblique; of under mandible very prominent, vertical. Frontal angles slight. Nostrils high up in basal third of bill. Cheek-feathers stiffish and bristly, with enlarged horny ends, extending on side of upper mandible in moderately convex outline, to about opposite those of chin. Wings short, vaulted, with curved primaries, the 1st and 2d subequal and longest; inner secondaries long and tapering. Tail short, about two-fifths the wing, 14-feathered. Coloration of ♂ black and white: ♀ brown, gray, and white. One remarkable species.

729. **C. labradorius.** (Of Labrador. Fig. 492.) LABRADOR DUCK. PIED DUCK. Adult ♂: Bill black with orange at base and along edges, and grayish-blue along the ridge; iris reddish-

brown; feet grayish-blue, with dusky webs and claws. Head and upper neck white, with a longitudinal black stripe on the crown and nape. Neck below ringed with black continuous with that of upper parts, then half-collared with white continuous with that of scapulars. Below, from this white, entirely black, excepting white axillars and lining of wings. Above, black, except as said; the wing-coverts and secondaries white, some of the latter margined with black; some of the long scapulars pearly-gray; primaries and their coverts and tail-feathers brownish-black. ♀: Bill, eyes, and feet as in ♂; several secondaries white, forming a speculum, but no white on wing-coverts or scapulars; axillars and lining of wings mostly white; inner secondaries edged with black; general color dappled brownish-gray, paler and more ashy or plumbeous on wing-coverts and inner secondaries. Length 18.00–20.00; extent about 30.00; wing about 9.00; tail 3.50; tarsus 1.50; middle toe and claw 2.50; bill along culmen 1.75, along gape 2.25. N. Am., along Atlantic Coast; breeds or did breed from Labrador northward, in winter ranging or did range S. to the Chesapeake. Extremely rare now, and apparently in fair way to become extinct. The same pair, procured by Daniel Webster, has served for Audubon's and Baird's descriptions, and for the present one; two fine mounted specimens have been lately acquired by the National Museum. In England, $200 has been offered for a good pair.

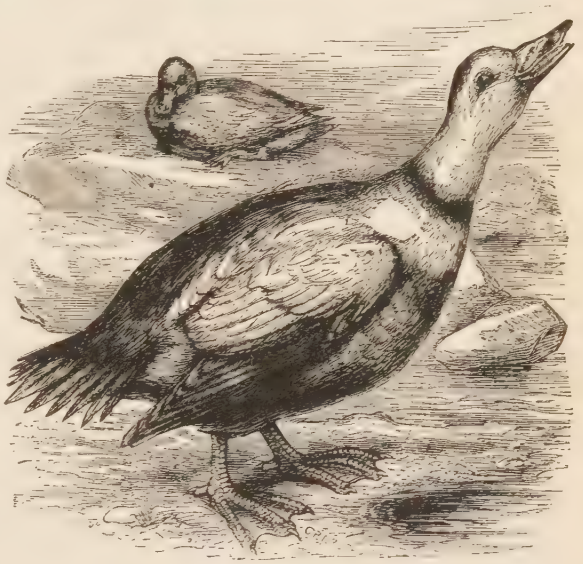


FIG. 492. — Labrador Duck. (From Ency. Brit.)

295. **HISTRIO'NICUS.** (Lat. *histrionicus*, histrionic, relating to *histrio*, a stage-player, the bird being tricked out in various colors, as if to play a part.) HARLEQUINS. Bill very small and short, shorter than head or tarsus, rapidly tapering to rounded tip which is wholly occupied by the large fused nail; but higher than wide at base, and with lateral upper corners as in *Fuligulinæ* generally, and convex sweep across its side of feathers, intermediate in extent between the frontal and mental projections, former reaching farthest. A membranous lobe at base of commissure formed by production of skin of cheeks. Nostrils in basal half of bill. Wings and tail short, latter pointed and about half as long as former. Longer scapulars and tertiaries curving outward over the wing as in eiders, with which this genus connects by means of *Heniconetta*, though in both these genera the bill is simple, as usual in *Fuligulinæ*, without the peculiar gibbosity and special outlines of feathers characteristic of eiders. One species, remarkable for its fantastic markings, being patched with different colors; a metallic speculum, here only among our *Fuligulinæ*, excepting *S. stelleri*.

730. **H. minu'tus.** (Lat. *minutus*, very small: not well chosen.) HARLEQUIN DUCK. Adult ♂: Bill olivaceous; iris reddish-brown; feet grayish-blue, with dusky webs and pale claws. Aside from the definite markings to be given, general color deep leaden-blue with a purplish tinge, blackening on top of head, on lower back, rump, and tail above and below, darker on head and neck than on breast and back, changing from breast backward, including lining of

wings, to sooty brown, on the flanks to chestnut-brown. A white patch between bill and eye, curving upward and backward to meet the black coronal stripe, changing to chestnut from over eye to nape. A round white spot on side of hind-head; a long white spot on side of upper neck: a white collar around neck, interrupted or not before and behind; a white crescent on side of breast in front of wings: these marks black-bordered. A white spot on wing-coverts: a white bar across ends of greater coverts and some of the secondaries; outer webs of inner secondaries mostly white: scapulars mostly white. A white spot on each side of root of tail. Speculum metallic purplish or violet. Two or three years appear to be required to perfect this plumage; the ♂ is found in almost every condition between this and the plumage of the ♀; the final stage is the completion of the white ring around neck and white tips of secondaries. ♀: Bill dusky; feet dull bluish-gray. Iris brown. A whitish spot before eye and behind ear. General plumage on head and upper parts dark brown, darkest on head and rump, the lower parts similar, more grayish, passing through gray mottling to whitish on belly. Thus the ♀ is a very small and obscure duck, widely different from the ♂; observe the small size, very short bill, only about 1.00 along culmen, higher than wide at base; plumage without definite markings excepting the two spots on each side of the head; extent of dappled gray and white on the under parts very variable. Length of ♂ 16.00–17.00; extent 24.00–27.00; wing 7.00–8.00; tail 3.00–4.00; tarsus 1.30; bill along culmen 1.10, along gape 1.50. Europe, Asia, N. Am., northerly and chiefly coastwise, but also in interior; S. in winter to Middle States and Cala.; breeds in R. Mts. of U. S., and northward, as from Newfoundland to Alaska. Nest in the hollow of a tree or stump, of weeds and grasses and parents' down; eggs 6–8, 2.10 × 1.60, greenish. The harlequins are in some places called "lords and ladies."

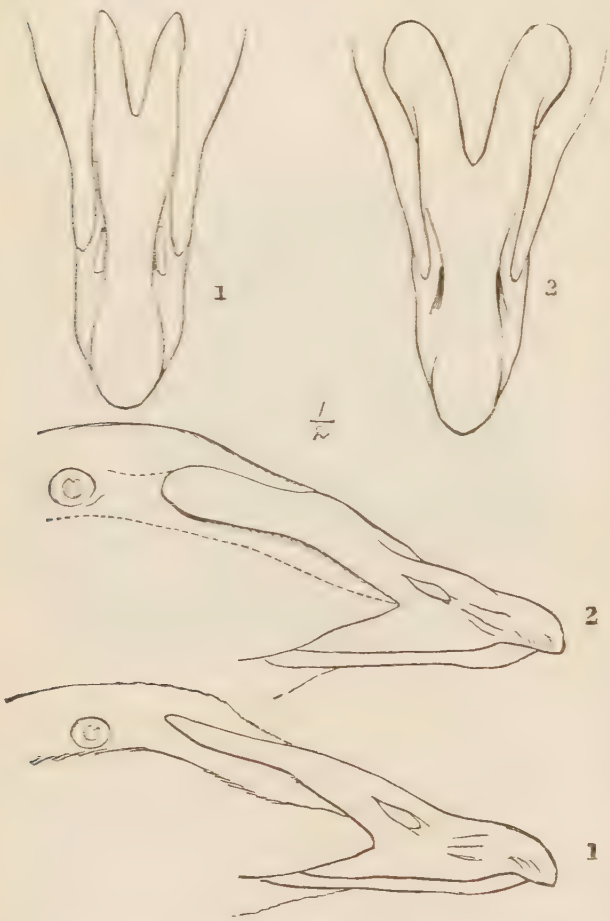


FIG. 493. — Bills of Eiders, ¼ nat. size, viewed from above and in profile. 1, *S. mollissima*: 2, *S. m. dresseri*. (From Sharpe.)

296. **SOMATERIA.** (Gr. *σῶμα, σώματος*, *soma, somatos*, the body; *ἔριον, erion*, wool, down.) EIDERS. Bill varying in conformation with the species; in one simple, much as in *Histrionicus* for example, without special gibbosity or peculiar outline of feathers; in the rest variously tumid or gibbous, with very various dispositions of frontal processes and outlines of

feathers. This is as in the scoters, *Œdemia;* in both of which genera the particulars of the bill being specific and in a measure sexual characters, to found genera upon them would be to make one for almost every species. Nevertheless, I am now satisfied that I have gone too far in uniting *Heniconetta* and *Arctonetta* with *Somateria.* The subgeneric rank accorded to these in the following analysis is to be considered as generic; and among the eiders proper I would now separate the king eider subgenerically, under the name of *Erionetta*, from *Somateria* proper. The characters are given below. In the whole group here presented under the name of *Somateria*, some further characters may be noted as follows: Nostrils averaging median, variable in position; feathers reaching over, under, or not to them. Frontal angles of bill in one species as normally in *Fuligulinæ*, in others variously exaggerated. Nail of bill large, fused, forming the whole tip. Inner secondaries and scapulars sickle-shaped, curved outward and falling obliquely over the wing. Sexes very unlike. ♂ chiefly black and white, with sea-green on the head; feathers of head in part short, close-set, and erect, like pile of velvet, in part usually stiffish and bristly. Several remarkable species, of the Northern Hemisphere.

Analysis of (Genera), Subgenera, Species, and Varieties

♂ ♀ Bill not gibbous, without frontal processes, not feathered to the nostrils, its cutting edge dilated and leathery; no unusual shape or outline of frontal feathers. (HENICONETTA.)
A violet speculum . . . . . *stelleri* 731
♂ ♀ Bill not gibbous, without frontal processes, feathered on culmen to a point beyond nostrils, and thence in line sweeping behind nostrils to angle of mouth. (ARCTONETTA.)
No speculum; an elevated roundish white black-bordered area about eye . . . . . *fischeri* 732
♂ Bill gibbous at base of upper mandible; outline of culmen variously curved; with long, acute or clubbed, tumid process extending in line with culmen on each side of forehead, divided by extension of feathers on culmen; feathers of side of bill advancing to about under nostrils, far beyond those on culmen. No speculum. (SOMATERIA proper.)
♂ No black V-mark on chin.
Frontal processes short, narrow, acute, parallel. Smaller . . . . . *mollissima* 733
Frontal processes long, broad, clubbed, divergent. Larger . . . . . *dresseri* 734
♂ A black V-mark on chin . . . . . *v-nigrum* 735
♂ Bill extremely gibbous at base of upper mandible, with broad squarish nearly vertical frontal processes bulging angularly out of line of culmen, on each side of forehead, divided by extreme projection of feathers on culmen far beyond those on sides of mandible, which do not nearly reach nostrils. (ERIONETTA N.)
♂ A black V-mark on chin . . . . . *spectabilis* 736

(HENICONETTA.)

731. S. (H.) stel'leri. (To G. W. Steller.) STELLER'S EIDER. Adult ♂: Bill and feet dull grayish-blue, the webs rather darker; iris brown. Top and sides of head and collar on neck silvery-white, washed across forehead and hind-head with sea-green, the chin with a black patch narrowing to run down breaking through the white collar and continuous with a broad black ring around neck; a similar patch around eye, these black areas with various lustre. Upper parts at large glossy purplish-blue-black; wing-coverts white; secondaries violet in their exposed portions, tipped with white, the rest, and the tertials and outer scapulars, silvery-white, the inner scapulars violet, striped with white edges: lining of wings, mostly, and axillars, white. Under parts dull chestnut-brown, passing to sooty black on the belly and crissum, with an isolated black spot on each side of the breast. The young ♂ closely resembles the ♀. In both sexes the bill and feet are of an undefinable dark color in dried specimens. ♀ differs as in all the eiders: dark reddish-brown, blackening on belly and crissum, much mottled and barred with black; no white except on lining of wings and tips of greater coverts and of secondaries, these forming two white bars enclosing the imperfect speculum. Length 18.00–19.00; wing 8.00–8.50; tail 3.50; bill 1.50 along culmen, 1.75 along gape; tarsus 1.25; middle toe and claw 2.20. Northern regions of Europe, Asia, and W. America; not yet common in collections, though abounding and sometimes gathering in enormous flocks on the islands and both shores of Behring's Sea and the Arctic coast of N. E.

Siberia; wintering mainly on the Aleutian Islands; usually found in company with Pacific, spectacled, and king eiders. Being observed to breed in a plumage resembling that of the ♀, this eider probably requires at least two years to acquire the complete dress. The most beautiful of many specimens I have handled have been winter birds. Eggs 7-9, 2.25 × 1.60, exactly like those of the common eider in shape, color, and texture of shell.

(ARCTONETTA.)

732. S. (A.) fis'cheri. (To Gotth. Fischer, a Russian naturalist. Fig. 494.) SPECTACLED EIDER. Bill (in both sexes) peculiar in the extension upon it of dense velvety feathers which reach to a point on the culmen beyond the nostrils, thence sweeping past the nostrils obliquely downward and backward to the commissure, the nostrils opening just beneath the line of feathers. Feathers of chin extending in a point nearly as far as those on culmen. A peculiarly dense and puffy patch of velvety feathers about the eye, suggesting spectacles; frontal feathers erect, pilous, in the ♂ somewhat stiffened; occipital feathers lengthened into a crest; these characters of the head-feathering best marked in the ♂, but indicated also in the ♀. Nail of bill distinct. Adult ♂: General color grayish-black, the neck and most of the back white; lesser and median wing-coverts, the curved tertials, the lining of wings and axillars, white; flanks white. On the head, the white of the neck gives way to rich sea-green, especially on the occipital crest; the frontal feathers are also tinged with greenish; but the 'spectacles' are pure silvery white, framed in black. Bill, in the dried state, dingy yellowish; feet the same, with dusky webs. Smaller than the common eider; wing 10.00; tail 4.00; tarsus 1.75; middle toe and claw 2.75; bill only about an inch long on culmen, but about 2.25 along gape. ♀: Greatly different, as in all the eiders. Bill black, with whitish nail of under mandible; feet quite dark. General plumage like that of the common eider, barred almost throughout with black, chestnut-brown, and yellowish-brown, giving way on the belly to dull brownish nebulated with dusky; on the head to pale brown streaked or otherwise obscured with dusky. Axillars white. Though thus so similar to the common eider in plumage, the peculiar feathering of the head and bill suffices to distinguish the bird at a glance. Northwest coast, common in some localities, from Unalashka northward to Norton and doubtless Kotzebue Sound; but its ordinary range appears to be a restricted one, nearly coincident with that of the emperor goose.

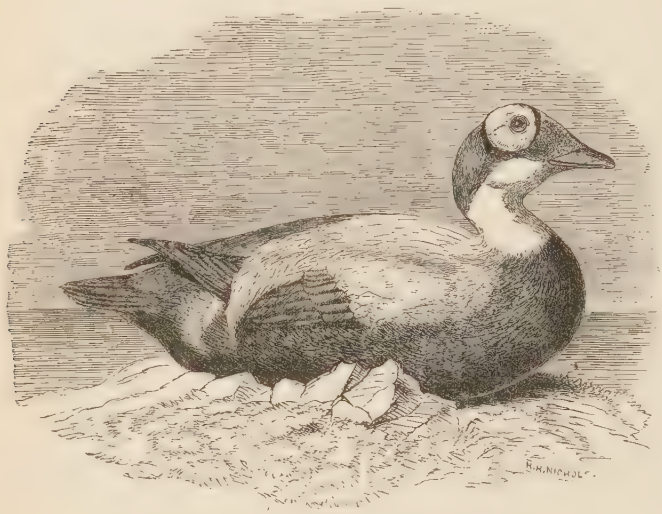


FIG. 494. — Spectacled Eider. (From Dall.)

(SOMATERIA.)

733. S. mollis'sima. (Lat. *mollissima*, very soft; referring to the down of the eider. Figs. 493, 495.) EUROPEAN EIDER DUCK. Bill (in both sexes) with lateral frontal process extending on each side of the forehead, between the short pointed extension of the feathers on the culmen and the

much greater extension of those on the sides of the bill, which reach to below the nostrils, about opposite those on the chin. The general upper outline of the bill nearly straight, and the frontal processes narrow, acute, and nearly parallel (see figs. and compare description of next subspecies). Adult ♂ : Plumage almost entirely black and white. Top of head glossy blue-black, including eyes, and forking behind to receive the white of the hind-head. Occiput more

FIG. 495. — Eider Ducks, $\frac{3}{10}$ nat size (From Brehm.)

or less washed with sea-green. Neck all around, fore breast, most of the back, most of the wing-coverts above and below, the curly tertials, and sides of rump, white, on the breast tinged with pale creamy-brown. Middle line of rump, upper tail-coverts, and under parts from the breast, black or blackish. Length about 24.00 ; extent 40.00 ; wing 11.00 ; tail 4.00 ; tarsus 1.75 ; middle toe and claw 3.75 ; culmen of bill 2.00 or less, from apex of frontal processes to tip 2.60 ; along gape 2.40. Adult ♀ : Sufficiently similar to the ♂ in character of bill, and

feathering of its base: plumage entirely different, being nearly everywhere varied, chiefly in bars, with black, chestnut-brown, and yellowish-brown, giving way on the under parts to grayish-brown with dusky nebulation. Size less than that of the ♂. This is the common eider of Europe, semidomesticated in some places, so famous for yielding the prized down of commerce, which the parent plucks from her breast to cover the eggs. It is also found in N. Am., as on Cumberland Sound: but the common American eider is of the following character.

734. **S. m. dres'seri.** (To H. E. Dresser, of England. Fig. 493.) AMERICAN EIDER DUCK. Like the last: plumage the same; form of the bill different, exhibiting an approach to the structure of that of *S. spectabilis*. General profile of culmen concave, the frontal processes being wider, higher, more obtuse, and more divaricating than in *S. mollissima* proper (compare figs. and foregoing description). The difference is very obvious on comparison of specimens, and may be held of specific value if no intermediate specimens are forthcoming. Culmen 2.00 or more; from apex of frontal processes to tip of bill about 3.00; along gape 2.50. ♀ differs as in the case of *S. mollissima* proper. N. Am., northerly, especially on the Atlantic coast; also on large inland waters: not noted from the N. Pacific; S. usually in winter to New England, more rarely to the Middle States; breeding from the Maine coast northward, abundantly in Newfoundland and Labrador, where it is one of the characteristic birds. Nest on the ground, of mosses, lichens, hay, and sea weed, to which feathers are added; eggs 6–10, usually fewer, plain dull greenish-drab, about 3.00 × 2.00, laid in June and July.

735. **S. v-nig'rum.** (Quasi-Lat. *v-nigrum*, noting the black V-shaped mark on the throat). PACIFIC EIDER. Like the two preceding, but with a large black V-shaped mark on the throat, pointing forward and forking behind, as in *S. spectabilis*. While the plumage is otherwise as in the common eider, the shape of the bill and character of its feathering are appreciably different, furnishing useful characters, especially in the case of the ♀. The frontal processes are acute and parallel, as in *S. mollissima*, but the gibbosity of the bill is greater than in *S. dresseri*; while the feathers upon its sides do not extend so far (scarcely or not reaching opposite the hind end of the nostrils), and have rounded instead of acute termination; their lower border is also more nearly parallel with the edge of the commissure. The extension of the feathers on the chin equals or even surpasses that on the side of the bill, rather the reverse being the case with *S. mollissima* and *dresseri*. Pacific coast from the Arctic Ocean to California, common in suitable localities on both coasts and islands of Behring's Sea, and the polar coasts of Siberia; replacing the common eider, and associated with the king, spectacled, and Steller's eiders.

736. **S. (E.) specta'bilis.** (Lat. *spectabilis*, conspicuous, spectacular.) KING EIDER. Characters of bill and its feathering quite differing from those of other eiders, and moreover varying much, not only in the two sexes, but in the ♂ at different seasons. In the adult ♂, in the breeding season, the bill develops immense rounded or squarish lateral frontal processes, bulging high out of line with the rest of the bill; these processes are soft, and moreover depend for their prominence upon the development of a mass of fatty substance upon which they are supported; they shrink and become more depressed in winter, when the general formation of the parts is not very different from that of other eiders. The frontal feathers extend in a definite line along the elevated culmen to about opposite the hind end of the nostrils; those of the side of the bill, on the contrary, fall far short of the nostrils; those of the chin reach about opposite those of the culmen; the whole feathered outline of the bill being thus very different from that of any other eider. In the ♀, though all the parts concerned are less developed, the same relative extension of feathers obtains, so that the bird is distinguished easily from the ♀ of any other eider; the culminal and mental feathers both reaching about opposite the nostrils, those on the side of the bill not extending nearly so far. Adult ♂: Black; the neck and fore part of the body, most of the wing-coverts and lining of wings, and a spot on each side of the rump, white; the white of the breast tinged with creamy brown; the curly tertials black (white in other eiders). A black V-shaped mark on the chin, as in *S. v-nigrum*. Top of head

and nape beautiful pearl-gray; sides of the head washed with sea-green; eyelids black; processes of the bill framed about with glossy black. Bill reddish; feet reddened, with dusky webs; iris brown. Length about 22.00; wing 11.00; tail 4.00; bill along culmen 1.25; along gape 2.25; from apex of processes to tip about the same; from feathers on side of upper mandible to tip about 1.60. Adult ♀: Indistinguishable from other female eiders in plumage, but readily recognized by the bill, as above said. Bill and feet blackish; dimensions of bill, aside from the frontal processes, nearly as in the ♂. This beautiful eider is a circumpolar species, abounding at various points along the shores of the Arctic Ocean, thence south in winter on the Pacific side in great numbers to the Aleutian Islands and beyond, though rare on the Alaskan coast of Behring's Sea; on the Atlantic side south rarely and irregularly to New York.

297. ŒDE'MIA. (Gr. *οἴδημα, oidema*, Lat. *œdema*, a swelling.) SCOTERS. SURF DUCKS. Bill tumid or gibbous in various character according to the species, and sexes of same species, and outline of feathers equally variable, but always farther on ridge than on sides of upper mandible, without angular reëntrance; terminally expansive, with large, elevated, and decurved nail, fused with and occupying whole tip. Nostrils in middle of bill or beyond. Feathers of chin running far forward, more or less nearly opposite nostrils. Color of ♂ black, relieved or not with white patches on head or wings, or both; bill singularly gibbous at base, parti-colored. ♀ sooty-brown, bill simply turgid, much widened at end. Young ♂ like ♀. Embracing the black sea-ducks, surf-ducks, scoters, or coots, as they are variously called; maritime mollusk-eating species, scarcely fit for food. Our three species inhabit both coasts, sometimes the larger inland waters, breeding northward, occurring abundantly in winter along the whole U. S. coasts.

Analysis of Subgenera, Species, and Varieties.

♂ Bill scarcely encroached upon by frontal feathers, which sweep directly across the base; gibbosity superior, circumscribed, orange. Nostrils median. Nail narrowed anteriorly. Color entirely black. Feet dark. Tail normally 16-feathered. (ŒDEMIA.)
  ♀ Sooty-brown, paler below, whitish on throat and sides of head; bill not gibbous, black . . . . . *americana* 737
♂ Bill broadly encroached upon by frontal feathers, on culmen nearly or quite to nostrils, on sides to less extent, shorter than head, the gibbosity superior, circumscribed. Nostrils beyond middle. Nail broad and obtuse. Bill black, orange-tipped; feet orange. Color black, with white wing-patch and eye-spot. Tail normally 14-feathered. (MELANETTA.)
  ♀ Sooty-brown, with white wing-patch; bill all black, less tumid . . . . . *fusca* 738
♂ Bill narrowly encroached upon by frontal feathers; on culmen nearly or quite to nostrils, on the sides not at all; about as long as head, the gibbosity lateral as well as superior. Nostrils beyond middle. Bill orange and white, with black lateral spot. Color black, with white frontal and nuchal patch, but none on wing; feet orange. Tail normally 14-feathered. (PELIONETTA.)
  ♀ Sooty-brown, paler below, whitish on head, chiefly in loral and auricular patches: bill black; feet dark.
    Frontal white patch reaching eyes; culminal feathers reaching opposite nostrils. Bill about as long as head . . . . . *perspicillata* 739
    Frontal white patch restricted; culminal feathers not reaching opposite nostrils. Bill rather exceeding head . . . . . *townbridgii* 740

737. Œ. america'na. (Fig. 496.) AMERICAN BLACK SCOTER. SEA COOT. Bill, etc., as above said. Adult ♂: Plumage entirely black, less glossy and jetty below than above, grayish on the inner webs of the quills. Iris brown. Feet blackish. Young ♂ resembling ♀. ♀: Sooty-brown, paler below, becoming grayish-white on belly, there dusky-speckled, on sides and flanks dusky-waved; throat and sides of head mostly continuous whitish, not in special spots; bill blackish, not bulging; feet livid olivaceous with black webs. Ducklings covered with black down. Length 17.00–20.00; extent 30.00–36.00; wing 8.00–10.00; tail 4.00; tarsus 1.75; middle toe and claw 3.25; bill 1.75–2.00. ♀ *much* smaller than ♂; near about these lesser figures. Differs from the European *Œ. nigra* in shape and color of the protuberance on the bill of ♂. N. Am., chiefly coastwise, where abundant; also on large inner waters; U. S. generally in winter; breeds in high latitudes. Eggs 6–8, 2.25×1.60, buff; nest on the

ground, in June, July. (N.B. The upper fig. 496 shows extent of feathers under bill — to first acute angle from the left — and shape of mandibular rami, reaching to next obtuse reëntrance.)

738. Œ. fus'ca. (Lat. *fusca*, dusky; adult ♂ is black.) Velvet Scoter. White-winged Surf Duck. Sea Coot. Bill, etc., as above. Adult ♂: Plumage black, paler below; a white speculum, formed by most of the secondaries and tips of greater coverts; a small white spot under eye. Iris yellow. Feet orange or carmine-red, with black webs. Young ♂ resembles ♀. ♀: Bill less bulging, entirely dark; eyes and feet as before, less bright. Sooty-brown, pale grayish below, but retaining the white speculum; whitish on head tending to form loral and auricular spots, as in 739, not 737. Largest: length 19.00–22.00; extent about 36.00; wing 11.00–12.00; bill along gape 2.50 or more; tarsus about 2.00; middle toe and claw 3.50. ♀ < ♂. Said to differ from European in greater encroachment of feathers on bill; but the ascribed feature is not tangible (var. *velvetina*). N. Am. at large, chiefly coastwise; also on large inland waters; abundant. Winters in U. S., breeds in high latitudes.

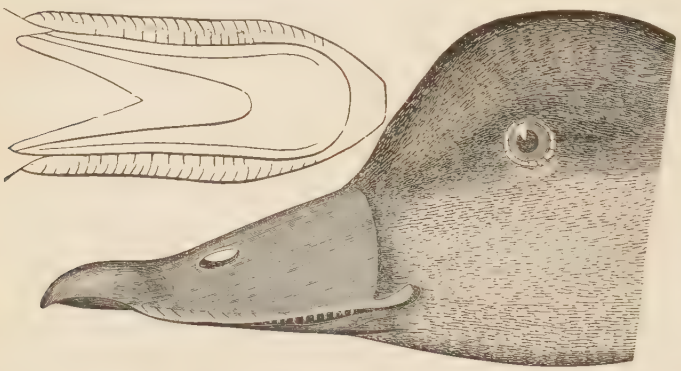


Fig. 496. — *Female* Black Scoter. (Ad nat. del. E. C.)

739. Œ. perspicilla'ta. (Lat. *perspicillata*, conspicuous, spectacular. Fig. 497.) Surf Duck. Sea Coot. Adult ♂: Bill, etc., as above, singularly variegated in color, mostly white or pinkish, and orange, with a great round or squarish black spot on side near base; iris pale yellow; feet orange, with dusky webs. Plumage glossy black, duller below; no white on wings, but a triangular white patch on forehead, pointing forward, reaching to or beyond opposite eye, and another on nape, pointing downward. Young ♂ resembles ♀, before the bill acquires distinctive shape and color. ♀: Bill blackish, not tumid, feathers of culmen restricted, not reaching opposite nostrils; feet dark, tinged with reddish, the webs blackish. Plumage sooty-brown, below silvery-gray; side of head with much whitish, chiefly in two patches, loral and auricular; no frontal or nuchal white. Length 18.00–21.00; extent 31.00–

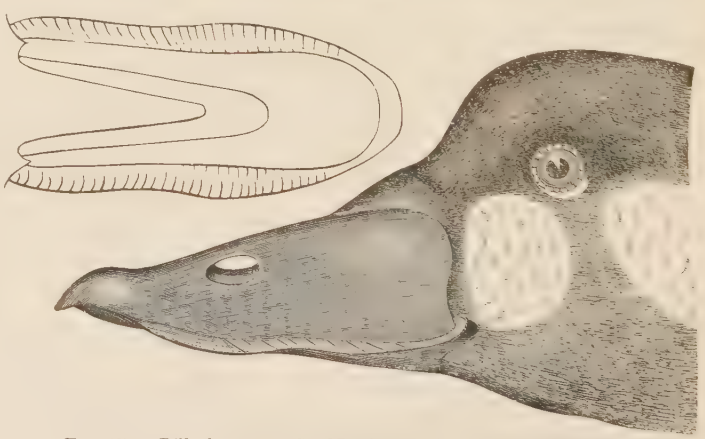


Fig. 497. — Bill of *young* ♂ Surf Duck, nat. size. (Ad nat. del. E. C.)

36.00; wing 9.00–10.00; tarsus 1.67; middle toe and claw 3.25; bill 2.25–2.50 along gape. N. Am. at large, casual in Europe; chiefly coastwise, also on larger interior waters; U. S. in winter, abundant, breeding in high latitudes. (N. B. In upper fig. 497 the first reëntrance indicates extent of feathering under the bill, the next the mandibular rami.)

740. **Œ. p. trowbrid'gii?** (To W. P. Trowbridge. Fig. 498.) With the bill longer, exceeding the head, and of slightly different shape; feathers falling short of nostrils; gape about 2.75; white frontal patch small, its posterior border anterior to a line between eyes, instead of reaching or passing beyond this. Coast of Cala. Scarcely tenable.

FIG. 498. — Trowbridge's Surf Duck, reduced. (From Elliot.)

298. **ERISMATU'RA.** (Gr. ἔρεισμα, *ereisma*, a stay, prop, pier, and οὐρά, *oura*, tail, as the stiffened member might seem to be.) RUDDER DUCKS. Remarkably distinguished from other *Fuligulinæ* excepting *Nomonyx* by the stiffened, linear-lanceolate tail-feathers, 16–20 in number, exposed to the base by reason of extreme shortness of the coverts, their shafts enlarged, channelled underneath; appearance of tail strikingly like that of a cormorant. Bill about as long as head, scarcely higher than broad at base, widened and depressed at end, which is almost turned up. Nail as viewed from above very small, narrow, and linear, greatly expanding on a decurved part bent under the end of the bill (unique). Head small, and neck thick; you can draw the skin of the ruddy duck over the head, which is impracticable with most ducks. Tarsus short, toes very long, the middle with claw twice as long as tarsus. One species.

741. **E. ru'bida.** (Lat. *rubida*, ruddy.) RUDDY DUCK. ♂, in perfect plumage: Neck all around and the upper parts and sides of body rich brownish-red, or bright glossy-chestnut. Lower parts silky silvery-white 'watered' with dusky, yielding gray undulations. Chin and sides of head dead-white; crown and nape glossy-black. Wing-coverts, quills, and tail, blackish-brown. Bill and edges of eyelids grayish-blue; iris reddish-brown; feet bluish-gray, with dusky webs. Not often seen in this faultless dress in the U. S. As generally observed, and ♀, brown above, finely dotted and waved with dusky; below paler and duller, more grayish, with dark undulations, and often a tawny wash, as also occurs on the white of the head; crown and nape dark brown; crissum white; bill dusky. Length 15.00–17.00; extent 20.00–24.00; wing 5.50–6.00; tail 3.50; tarsus 1.25; middle toe and claw 2.60; bill 1.50. A curious and interesting duck, abundant in N. Am. at large, wintering in U. S., breeding from N. border of U. S. northward. It is an expert diver, and swims well under water, when its rudder comes into use, like a cormorant's; it is held cocked up when not in use, so that this duck does not slope down behind as most do on the water. When alarmed, it sometimes sinks quietly backward into the water, like a grebe; but some other sea ducks, as the harlequin, will do the same. The tail well illustrates a method in which early down-feathers are supplanted by true quills. Up to the time the flappers are 8 or 10 inches long, the true tail-feather bears at its end the simple stem of the down-feather, terminating in a bushy tuft of loose barbs; the whole affair then breaks off and falls. (See Am. Nat., xii, 1878, p. 123, fig.)

299. **NOMO'NYX.** (Gr. *νόμος, nomos*, law, order; *ὄνυξ, onux*, nail: nail of bill ordinary.) RUDDER DUCKS. Character of *Erismatura*, but nail of bill not peculiar. Inner secondaries so lengthened as to fold over the primaries in the closed wing.

742. **N. domi'nica.** (Of St. Domingo.) ST. DOMINGO DUCK. General color ferruginous, or chestnut-red, more or less extensive and continuous on under parts and around neck, varied

with black on the back; crown of head black; a large white area on the wing formed by many of the coverts and bases of the secondaries; axillars also white. A ♀ or young ♂ specimen has the back blackish, spotted with yellowish-brown; the general ferruginous color dappled with dusky; and two blackish stripes on each side of head. Length about 13.00; wing 5.00; tail 3.00; tarsus 1.00; culmen 1.40. A small and curious duck of C. and S. Am. and W. I., accidental in the U. S., as on Lake Champlain and in Wisconsin (see Proc. Bost. Soc. Nat. Hist., vi, 375; xiv, 154; Amer. Nat., v, 441; and *Baird*, B. N. A., 1858, 925).

69. Subfamily MERGINÆ: Mergansers.

Bill narrow, more or less nearly cylindrical, the nail hooked and overhanging, the lamellæ highly developed into prominent serrations, the nasal fossæ lengthened and narrowed. Excepting the character of the bill, the 'saw-bill' or 'fishing-ducks' are simply *Fuligulinæ*, somewhat modified in adaptation to a more exclusively animal regimen; the lamellæ of the bill become detainers of large objects, not sifters or strainers of minute things. The principal point in their economy is ability to pursue fish under water, like Cormorants, Loons, and other birds of lower orders. The nature of their food renders their flesh rank and unpalatable; in buying a 'duck,' notice the bill, that it be not cylindric, hooked, and saw-toothed; the flap of the hind toe is as in any Sea Duck; the tarsi are much compressed. The gizzard is rather less muscular than in most ducks; the intestines and their cœca are shorter; the syringeal capsule of the ♂ is very large, irregular, partly membranous; the trachea has other dilatations (fig. 3). Birds of this group inhabit fresh as well as salt water, and are abundant in individuals if not in species. There are about 8 species, chiefly of the Northern Hemisphere, but several occur in South America: we have 3, commonly and perhaps properly referred to 2 genera, *Mergus* and *Lophodytes*.

300. **MER'GUS**. (Lat. *mergus*, a diver; *mergo*, I merge in.) MERGANSERS. FISHING DUCKS. SAW-BILLS. Bill as above said. Nostrils median or sub-basal. Tarsi compressed, anteriorly scutellate, with smaller plates on sides and behind, one-half to two-thirds as long as middle toe and claw. Hind toe lobate. Tail rounded, usually one-half or more the length of the pointed wings. Head usually crested.

Analysis of Subgenera and Species.

Bill not shorter than head, mostly red. Serrations of bill acute, recurved, claw-like. Tarsus about two-thirds as long as middle toe. Tail about half as long as wings. Crest low, flimsy, occipital, if any. Head green or brown. (MERGUS.)
- Nostrils near middle of bill. Frontal feathers beyond those on side of bill. Crest scarcely developed. ♂ with breast uncolored . . . . . *merganser* 743
- Nostrils near base of bill. Frontal feathers not beyond those on side of bill. Crest better developed. ♂ with breast and sides colored . . . . . *serrator* 744

Bill shorter than head, mostly black. Serrations of bill low, oblique, not hooked. Tarsus about half as long as middle toe. Tail more than half as long as wing. Crest of ♂ highly developed, erect, compressed, semicircular, coronal as well as occipital. (LOPHODYTES.)
- Nostrils near base of bill. Frontal feathers produced beyond those on sides of bill . . . *cucullatus* 745

743. **M. mergan'ser**. (Lat. *mergus* and *anser*, diver-goose. Fig. 499.) MERGANSER. GOOSANDER. Nostrils near middle of bill. Frontal feathers extending acutely on culmen about half way from those on side of bill to nostrils; loral feathers sweeping in nearly vertical line across side of base of upper mandible, about opposite those on side of lower mandible. Head scarcely crested, merely a line of little lengthened feathers along occiput and nape, better developed, however, in ♀ than in ♂. Adult ♂: Bill and feet vermilion-red in breeding season, with black hook; iris carmine. Head and neck splendid dark green. Under parts salmon-colored, the flanks and lower belly marbled or watered with dusky. Upper parts glossy-black, fading to ashy on rump and tail; surface of wing mostly pure white, crossed by a black bar formed by bases of greater coverts. Primaries and outer secondaries black, inter-

mediate secondaries white, inner secondaries and scapulars black and white. ♀: Bill red with dusky culmen, iris yellowish, feet chrome or orange with dusky webs, crest better developed than in ♂; still flimsy, however long. Head and neck reddish-brown; throat white; under parts less salmon-tinted. Black parts of ♂ ashy-gray; scapulars without white; white of wing restricted to secondaries and greater coverts, which are black at base; smaller coverts ashy. Length 23.50–27.00; extent 34.00 or more; wing 10.00–11.00; tail 5.00; bill 2.00 along culmen, 3.00 along gape; tarsus 1.75; middle toe and claw 2.75; ♀ much smaller than ♂, at the lesser or below the single dimensions here given. N. Am. bird said to differ in slighter and lower crest, and evident black bar in white of wing, concealed in European. N. Am. at large, common; U. S. in winter, and breeding from N. States northward. Nest on ground, down-lined; eggs 6–8, elliptical, buff-colored, 2.75 × 2.00.

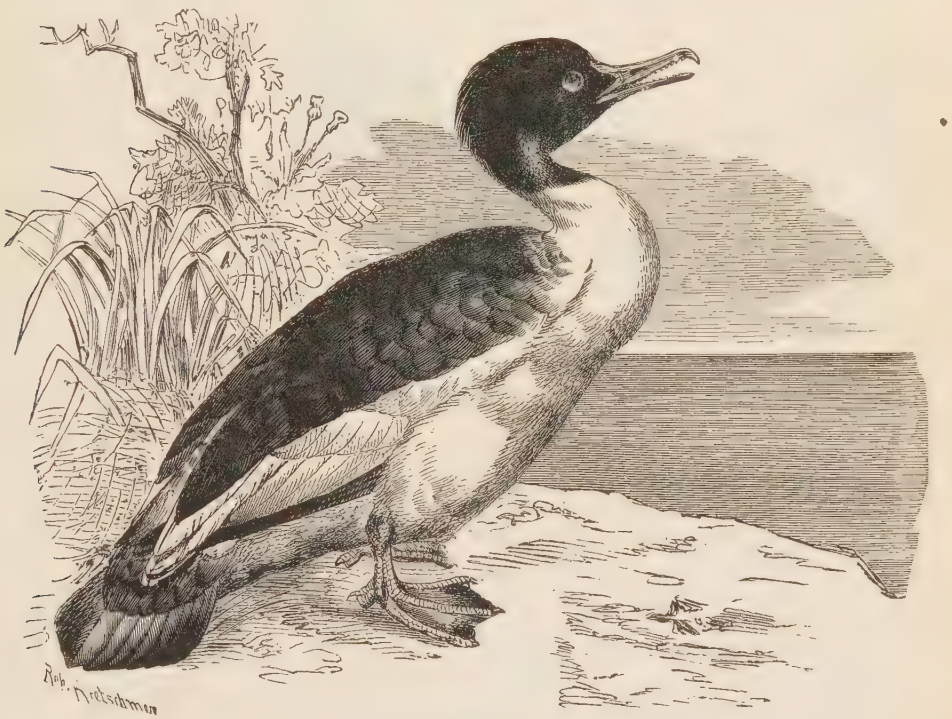


FIG. 499. — Merganser, ♂, ½ nat. size. (From Brehm.)

744. M. serra'tor. (Lat. *serrator*, a sawyer. Fig. 500.) RED-BREASTED MERGANSER. Nostrils near base of bill. Frontal feathers extending obtusely on culmen, and not beyond those on sides of upper mandible; the loral sweeping forward convex beyond those on side of lower mandible. A long, thin, pointed occipital and nuchal crest in both sexes. Adult ♂: Head and neck all around splendid dark green. A white ring round neck. Under parts white, more or less salmon-tinged, the fore-breast brownish-red streaked with dusky, the sides finely waved with dusky. A white black-bordered patch of broad feathers in front of the wing. Fore-back, interscapulars, and long inner scapulars, black; middle and lower back gray, waved with whitish and dusky. Surface of wing mostly white, including outer scapulars; inner secondaries edged on outer web with black, and wing crossed by two black bars at bases and just beyond ends of greater coverts. Bill carmine-red, dusky along the top; eyes carmine; feet bright red. ♀: Bill and feet duller colored; head grayish-chestnut;

throat and under parts white, shaded with ashy-gray along the sides. Upper parts plumbeous-gray, the feathers with paler edges; white of wing restricted to a patch formed by the ends of the greater coverts, and much of the outer secondaries; not divided by a black bar. No peculiar feathers in front of wing. Length about 24.00; extent 34.00; wing 8.50–9.50; tail 4.00; tarsus 1.60; middle toe and claw 2.60; bill 2.20 on culmen, 2.60 on gape. Young ♂ like ♀. Nestlings in down curiously patched. N. Am. at large, more numerous than the goosander. U. S. abundantly in winter, and breeding in many places as well as farther north. Also European, etc. Nest on ground, down-lined; eggs 8–10, elliptical, buff, 2.50 × 1.65.

745. M. (L.) cucul/a/tus. (Lat. *cucullatus*, wearing a hood). Hooded Merganser. Bill shorter than head. Nostrils in its basal half. Frontal feathers extending far beyond those on side of bill, these beyond those on lower mandible. A magnificent erect crest, compressed, semicircular in outline, in both sexes, but in ♀ smaller, and less strict. Adult ♂: Bill black; eyes yellow; feet light brown, with dusky claws. Head, neck, and upper parts black, changing to brown on lower back; crest elegantly centred with snowy white; lower fore-neck and under parts white, the sides regularly and finely waved with brownish-red and black; crissum waved with dusky. Lining of wings and axillars white. Enlarged white doubly black-barred feathers in front of wing. A white speculum, with two black bars, the white being on outer webs of secondaries and ends of these and greater coverts; inner secondaries with white central stripe. Young ♂ like ♀. ♀: Bill dusky, with orange base below. Head and neck gravish-chestnut, darker brown on crown, the throat and under parts whitish; back and sides dusky-brown, the latter not undulated, the feathers generally with paler edges. No black and white bars before wing; white of wing restricted or impure. Length 16.50–18.00; extent about 25.00; wing 7.00–8.00; tail 4.00; tarsus 1.20; middle toe and claw 2.25; bill 1.50 along culmen, 2.00 along gape. N. Am. at large; common; breeds at large in U. S., as well as farther north; winters in U. S. Europe, etc. This beautiful species appears to usually if not always nest in trees, like the wood duck and some others, the young being transported to the water in the beak of the mother. Eggs 6–8, 1.75 ×1.35, elliptical, buff-colored.

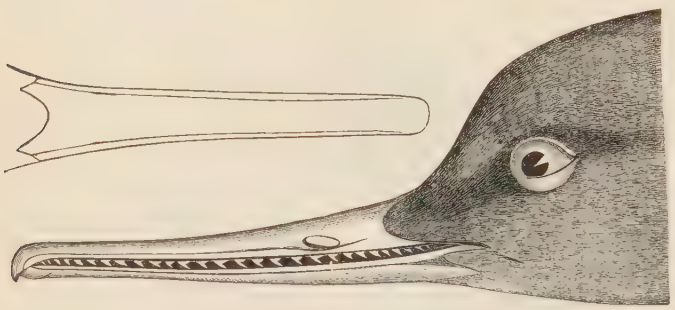


Fig. 500. — Bill of Red-breasted Merganser, nat. size. (Ad nat. del. E. C.)

XI. Order STEGANOPODES: Totipalmate Birds.

Feet totipalmate, with three full webs (as in fig. 52, for example); hind toe semi-lateral, larger and lower down than in other water birds, *connected with the inner toe by a complete web reaching from tip to tip.* Nostrils minute, rudimentary, or entirely abortive. A gular pouch. Bill not membranous nor lamellate; tomia sometimes serrate; usually, a long sulcus on upper mandible reaching alongside the culmen nearly to tip of bill, which is commonly hooked with a more or less distinct nail; mouth much cleft.

This is a definite and perfectly natural group, which will be immediately recognized by the foregoing characters, one of which, the complete webbing of the hallux, is not elsewhere

observed among birds. It is represented by six genera, all North American, each the type of a family.

The nature is altricial. The eggs are very few, frequently only one, usually if not always plain-colored, and encrusted with a peculiar white chalky substance; they are deposited in a rude bulky nest on the ground, on rocky ledges, or on low trees and bushes in the vicinity of water. The dietetic regimen is exclusively carnivorous, the food being chiefly fish, sometimes pursued under water, sometimes plunged after, sometimes scooped up. In accordance with this, we find the alimentary canal to consist of a capacious distensible œsophagus not developing a special crop, a large proventriculus with numerous solvent glands, a small and very moderately muscular gizzard, rather long and slender intestines, with small cœca, if any, and an ample globular cloaca. The tongue is extremely small, a mere knob-like rudiment (as in the piscivorous kingfishers). The characteristic gular pouch varies greatly in development. The condition of the external nostrils is a curious and unexplained feature; they appear to be open at first, and in some species, like the tropic-bird, they remain so; but they are generally completely obliterated in the adult state. There are probably no intrinsic syringeal muscles in any birds of this order. But the most notable fact in connection with the respiratory system is the extraordinary pneumaticity of the body, which reaches its height in the pelicans and gannets. The interior air receptacles are of an ordinary character, but the anterior of these cells are more subdivided than usual; from them, the air gets under the skin through the axillary cavities, and diffuses over the entire pectoral and ventral regions, in two large parallel inter-communicating cells on each side, over which the skin does not fit close to the body, but hangs loosely. It is further remarkable that the skin itself does not form a wall of these cavities, a very delicate membrane being stretched from the inwardly projecting bases of the contour-feathers. Thus there is yet another, although a very shallow, interval between this membrane and the skin, this also containing air, admitted from the larger spaces by numerous minute orifices close to the roots of the feathers. This subcutaneous areolar tissue is that which, in ordinary birds and mammals, holds the deposit of fat, no trace of which substance is found in these birds.

The pterylosis adheres throughout to one marked type, there being little variation except in the density of the plumage, which would seem to accord with temperature, the tropical forms being the more sparsely feathered. Excepting *Phaëthon*, the gular sac is wholly or in part bare. The contour feathers appear to always lack aftershafts. The remiges are from 26 to 40 in number, of which 10 are always long, strong, pointed primaries. There are usually 22–24 tail-feathers in the pelicans, but 12, 14 or 16 in the other genera. All have the oil-gland large, with a circlet of feathers and more than one orifice; sometimes, as in the pelicans, it is protuberant, heart-shaped, as large as a pigeon egg, with two sets of six orifices; in the gannets it is flat and disc-like.

The palatal structure is extremely desmognathous; there are no basipterygoids; the maxillo-palatines are large and spongy; the mandibular angle is truncate; other cranial characters appear under two aspects, one peculiar to the pelicans, the other common to the rest of the order. The sternum is short and broad, with transverse, entire or emarginate, posterior border; the apex of the furculum commonly, if not always, anchyloses with the sternal keel. The upper arm bones are very long; the tibia does not develop the very long cnemial apophysis or so called 'rotular process' seen in many *Pygopodes*. (See fig. 502.) The carotids are double; tufted oil-gland, cœca and ambiens muscle are present.

The species of this order are few — apparently not over fifty, of which the Cormorants represent half — very generally distributed over the world.

53. Family SULIDÆ: Gannets.

Bill rather longer than head, cleft to beyond eyes, very stout at base, tapering and a little decurved toward tip, which however is not hooked, the tomia irregularly serrate, or rather lacerate. An evident nasal groove. Nostrils abortive. Gular sac little developed, but naked. Wings rather long, pointed. Tail long, stiff, wedge-shaped, 12–14 feathered. Feet stout and serviceable, more nearly beneath centre of equilibrium than in some other families of this order. General configuration somewhat that of a goose; body stout; neck rather long; head large, uncrested; plumage compact. Marine.

Two carotids. Oil-gland disc-like. Cœca very small. Gall-bladder large. Pneumaticity extreme, even to intermuscular air-cells. Ambiens, femoro-caudal, and semitendinosus present: accessories absent; former with a peculiarity of insertion. The relationships of the family are decidedly with the Cormorants.

Gannets are large heavy sea-birds of various parts of the world. There are only five or six well-established species, of which the two following, with the *S. piscator* of the Indian Ocean, and the Australian *S. cyanops*, are the principal ones. They are piscivorous, and feed by plunging on their prey from on high, when they are completely submerged for a few moments; but they do not appear to dive from the surface of the water like Cormorants. The gait is firm; the flight vigorous and protracted, performed with alternate sailing and flapping. Although so heavy, they swim lightly, owing to the remarkable pneumaticity of the body, already noticed. They are highly gregarious; the common Gannet congregates to breed in almost incredible numbers on rocky coasts and islands, of high latitudes, while the Booby similarly assembles on the low shores of warmer seas. The nest is a rude bulky structure of sticks and seaweed, placed on the rock or in low thick bushes; the egg, generally single, is plain in color and encrusted with calcareous matter. Both sexes appear to incubate; they are alike in color, the young being different.

301. **SU'LA.** (Norse *sule*, a booby.) GANNETS. Character of the family, as above. The white Gannet, type of *Sula*, differs subgenerically from the brown Boobies (*Dysporus*).

Analysis of Species.

White, with black primaries, head washed with amber-yellow; bill not yellow; lores, sac, and feet blackish. Young spotted . . . . . *bassana* 746

Brown, below from the neck white; bill and feet yellow. Young not spotted . . . . . *leucogastra* 747

746. **S. bassa'na.** (Of Bass Rock, Firth of Forth.) COMMON GANNET. WHITE GANNET. SOLAN GOOSE. Adult ♂ ♀: Bill pale grayish, tinged with greenish or bluish; the nasal groove, lores and gular sac blackish, as are the feet; iris white. Plumage white, the primaries black, the head washed with amber-yellow. Length 3 feet or more; extent 6 feet, more or less; wing 17–21 inches; tail 9.00–10.00, pointed, 12-feathered; bill along culmen 4, along gape 6; tarsus 2.00; middle toe and claw 4.00. Young: Bill brownish, the lores livid bluish; feet dusky; iris green. Plumage dark brown, spotted with white, below from the neck grayish-white, each feather darker-edged (character much as in a young night-heron); wing-quills and tail-feathers blackish. Atlantic Coast, swarming in summer at certain northern breeding places, as at "Gannet Rock" in the Gulf of St. Lawrence, S. to the Gulf of Mexico in winter. Nest of seaweed: egg single, 3.00 × 2.00, pale greenish-blue flaked over with white chalky substance. Young hatch naked, blackish, pot-bellied; then are covered with thick yellowish down.

747. **S. leucogas'tra.** (Gr. λευκός, *leucos*, white; γαστήρ, *gaster*, belly.) BROWN GANNET. BOOBY. Adult ♂ ♀: Bill and bare spaces about head, and feet yellow, former paler or flesh-color toward end. Iris white. Plumage dark brown, below white from the neck. Young: Bill dusky; feet dark; plumage grayish-brown, paler below. Length about 30.00;

extent 48.00; wing 16.00; tail 8.00, pointed, 12-feathered; tarsus 1.50; middle toe and claw 3.50; bill along culmen 3.75, along gape 5.00. S. Atlantic and Gulf States, very abundant, swarming at its breeding places along the low shores and keys; nest of sticks and weeds, in bushes; egg single, character as before, 2.50 × 1.75.

54. Family PELECANIDÆ: Pelicans.

FIG. 501. — Bill of North American White Pelican.

Bill several times as long as the head, comparatively slender, but strong, straight, broad, flattened, grooved throughout, ending with a distinct claw-like hook. Mandibular rami joining only at their apex; the long broad interramal space, and the throat, occupied by an enormous membranous sac. Nostrils abortive. Wings extremely long, in the upper- and fore-arm portions, as well as the pinion, with very numerous remiges. Tail very short, of 20 or more feathers. Feet short, very stout. Size large.

The remarkable pneumaticity of the body (shared however by the gannets) has been already described. A principal osteological character is, that "the inferior edge of the ossified interorbital septum rises rapidly forward, so as to leave a space at the base of the skull, which is filled by a triangular crest formed by the union of the greatly developed ascending processes of the palatines." The sternum is short and broad, with shallow emargination on each side behind: the furculum is firmly anchylosed with it. The cœca are an inch long. The tongue is a mere rudiment. But the most obvious peculiarity of these birds is the immense skinny bag hung to the bill, capable of holding several quarts when distended; its structure is as follows: The covering is ordinary skin, but very thin; the lining is skin modified somewhat like mucous membrane; between these "is interposed an equally thin layer, composed of two sets of very slender muscular fibres, separated from each other, and running in opposite directions. The outer fibres run in fascicles from the lower and inner edge of the mandible, those from its base passing downward, those arising more anteriorly passing gradually more forward, and reach the middle line of the pouch. The inner fibres have the same origin, and pass in a contrary direction, backwards and downwards. From the hyoid bone to the junction of the two crura of the mandible, there extends a thin band of longitudinal muscular fibres, in the centre of which is a cord of elastic tissue. By means of this apparatus, the sac is contracted, so as to occupy but little space. When the bill is opened, the crura of the lower mandible separate from each other to a considerable extent [in their continuity — not at the symphysis], by the action of muscles inserted into their base, and the sac is expanded." This organ is used like a dip-net, to catch fish with; when it is filled, the bird closes and throws up the bill, contracts the pouch, letting the water run out of the corners of its mouth, and swallows the prey. Pelicans feed in two ways; most of them, like our white one, scoop up fish as they swim along on the water; but the brown species plunges headlong into the water from on wing, like a gannet, and makes a grab, often remaining submerged for a few seconds. Neither species often catches large fish; they prefer small fry of which several hundred may be required for a full meal. The prevalent impression that the pouch serves to convey live fish, swimming in water, to the little pelicans in the nest, is untrue; the young are fed with partially macerated fish disgorged by the parents

from the crop. As Audubon remarks, it is doubtful whether a pelican could fly at all with its burden so out of trim.

The gular pouch varies in size with the different species, reaching its greatest development in the brown pelican, where it extends half-way down the neck in front, is a foot deep when distended, and will hold a gallon. Besides this singular adjunct, the bill of our white pelican has another curious structure, not found in other species. The culmen is surmounted near the middle by a high thin upright comb or crest, the use of which is not known. It is found during the breeding season alone, being shed and renewed in a manner analogous to the casting of deer's horns. Its structure explains how this can be: "The crest-like excrescence on the ridge of the upper mandible is not formed of bone, nor otherwise connected with the osseous surface, which is smooth and continuous beneath it, than by being placed upon it, like any other part of the skin; and when softened by immersion in a liquid may be bent a little to either side. It is composed internally of erect slender plates of a fibrous texture, externally of horny fibres, which are erect on the sides, and longitudinal on the broadened ridge; these fibres being continuous with the cutis and cuticle."

Pelicans are found in most temperate and tropical countries, both coastwise and inland; they are gregarious birds at all times, and gather in immense troops to breed. A large rude nest is prepared on the ground, or built of sticks in a low bush near the water; the eggs appear to be one to three, plain dull whitish, with a thick roughened shell. The gait of these cumbersome birds is awkward and constrained; but their flight is easy, firm, and protracted, and they swim lightly and gracefully, buoyed up by the interior air-sacs. The sexes are alike; the young different; most species are white, with yellow or rosy hue at times, and a crest or lengthened feathers, at the breeding season; while nearly every one of them has a peculiar contour of the feathering at the base of the bill, by which it may be known. There are only six unquestionable species, although some authors admit eight or nine. The four exotic ones are: *P. onocrotalus* of Europe, Asia, and Africa (including the *P. minor* and *javanicus* of authors), with the frontal feathers extending in a point on the culmen; *P. crispus* of the same countries, the largest of the genus, and *P. rufescens* (with *philippinus*) of various parts of the Old World, in both of which the frontal outline is concave on the base of the culmen; and finally, the Australian *P. conspicillatus*, in which a strip of feathers cuts off the naked circumocular region from the base of the bill. This is an entirely peculiar feature; and our white pelican shows another, having the sides of the under mandible feathered at base for a short distance.

302. **PELECA'NUS**. (Gr. *pelecanus*, a pelican.) PELICAN. Character as above.

748. **P. trachyrhyn'chus**. (Gr. τραχύς, *trachus*, rough; ῥύγχος, *hrugchos*, beak. Fig. 501.) AMERICAN WHITE PELICAN. Adult ♂ ♀: Plumage white, with black primaries, their coverts, alula, and many of the secondaries, the shafts of the quills white. Lengthened feathers of occiput and breast, and some of the lesser wing-coverts, pale straw-yellow. Tail-feathers said to be rosy at times; and a dark spot to appear on the occiput after the breeding season. Iris pearly white, at times or in young, brown or dusky. Bill and feet ordinarily yellow; much reddened in the breeding season, when the general tone of the bill is reddish salmon color, the under mandible brighter than the upper, which has the ridge whitish; pouch passing from livid whitish anteriorly through yellow and orange to red at base; bare skin about eye orange; eyelids red; feet intense orange-red. Length 5 feet; extent 8–9 feet; wing 2 feet or more; bill a foot or more; fore-arm about 15 inches; tail 6.00, 24-feathered; tibia bare 1.00; tarsus 4.50; middle toe about 5.00. This magnificent bird ranges over temperate N. Am. at large, but irregularly; rare, casual, or wanting in Middle and Eastern States and beyond; S. Atlantic and Gulf States, common; and generally in the West abundant in suitable places, inland as well as coastwise, up to 61° N. at least. Breeds in colonies, sometimes of vast extent; nest merely a heap of earth; egg single.

749. **P. fus'cus**. (Lat. *fuscus*, brown.) AMERICAN BROWN PELICAN. Adult ♂: Bill mottled

with light and dark colors, much tinged in places with carmine; eyes white; bare space around them blue; eyelids red; pouch blackish; feet black. Plumage dark and much variegated. Head mostly white, tinged with yellow on top, the white extending down the neck as a bordering of the pouch and somewhat beyond; rest of neck dark chestnut. Upper parts dusky, each feather pale or whitish-centred, the paler gray color prevailing on the wing-coverts. Primaries blackish, their shafts basally white; secondaries dark, pale-edged; tail-feathers gray. Lower parts grayish-brown, striped with white on the sides; the lower fore-neck varied with yellow, chestnut, and blackish. ♀ said to lack the chestnut coloring of the neck (?) Length about 4.50 feet; extent 6.50 feet; wing 2 feet; bill a foot or more, the gular pouch extending about the same distance along the neck. Tail 7.00, 22-feathered; tarsus 2.50; middle toe and claw 4.50. The bill and soft parts very variable in color with age or other circumstance. Young lack the special coloration of the neck, which is simply dark brown. At first, covered with whitish down. The feathers of the neck of the adult are peculiarly soft and downy; there is a slight nuchal crest, with stiff bristly feathers on the forehead, and lengthened acute feathers on the lower foreneck and breast. The brown pelican is exclusively maritime, inhabiting both coasts of America from tropical regions to Carolina and California. It plunges for its prey like a gannet, not scooping it up swimming like the white pelican. Breeds in colonies, indifferently on the ground or on bushes and low trees. Eggs 2–3, white, chalky, elliptical, 3.00 × 2.00.

55. Family PHALACROCORACIDÆ: Cormorants.

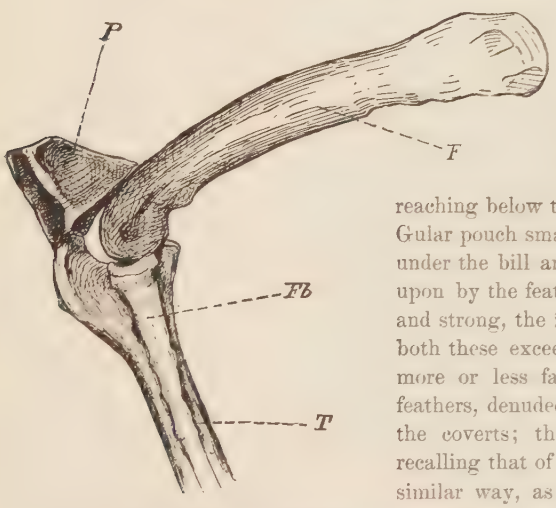


FIG. 502. — Knee-joint of *Phalacrocorax bicristatus*, nat. size, from nature by Dr. R. W. Shufeldt. F, femur; P, patella; T, tibia; Fb, fibula.

Bill about as long as head, stout or slender, more or less nearly terete, always strongly hooked at the end; tomia generally found irregularly jagged, but not truly serrate; a long, narrow, nasal groove, but nostrils obliterated in the adult state; gape reaching below the eyes, which are set in naked skin. Gular pouch small, but forming an evident naked space under the bill and on the throat, variously encroached upon by the feathers. Wings short for the order, stiff and strong, the 2d primary usually longer than the 3d, both these exceeding the 1st. Tail rather long, large, more or less fan-shaped, of 12–14 very stiff, strong feathers, denuded to the base by extreme shortness of the coverts; thus almost "scansorial" in structure, recalling that of a woodpecker or creeper, and used in a similar way, as a support in standing, or an aid in scrambling over rocks and bushes. The body is compact and heavy, with a long sinuous neck; the general configuration, and especially the far backward set of the legs, is much like that of pygopodous birds. While other *Steganopodes* can stand with the body more or less nearly approaching a horizontal position, the cormorants are forced into a nearly upright posture, when the tail affords with the feet a tripod of support. They also, like the birds just mentioned, dive and swim under water in pursuit of their prey, using their wings for submarine progression, which is not the case with the other families, excepting *Plotidæ*. In both these families the body is not in the least pneumatic under the skin — quite the reverse of Pelicans and Gannets.

Among osteological characters, aside from the general figure of the skeleton, a long bony

style in the nape, in the position of the *ligamentum nuchæ* of many animals, and articulated with the occiput, is the most remarkable (fig. 505). It occurs in the Anhinga also, but is there much smaller. The desmognathous structure is seen in its highest development; the palatines being not only soldered, but sending down a keel along their line of union; the interorbital septum is very defective, with horizontal inferior border (a general character of the order except in the Pelicans). The sternum and shoulder-girdle, and the knee, are shown in figs. 504, 502. In the knee-joint, there is a bulky free patella, coexistent with a short cnemial apophysis or rotular process of the tibia, but perfectly distinct therefrom, as in *Podiceps*. The muscles of the legs are as in *Sulidæ*. The pterylosis agrees essentially with the ordinal pterylographic characters, but the plumage is peculiar in certain details. Excepting a few speckled species, and some others that are largely white below, the plumage is glossy or lustrous black, often highly iridescent with green, purple, and violet tints, commonly uniform on the head, neck, and under parts, but on the back and wing-coverts, where the feathers are sharp-edged and distinct, the shade is more apt to be coppery or bronzy, each feather with well-defined darker border. This concerns, however, only the adult plumage, which is the same in both sexes; the young are plain brownish or blackish. The Cormorants have other special featherings, generally of a temporary character, assumed at the breeding season and lost soon after; these are curious

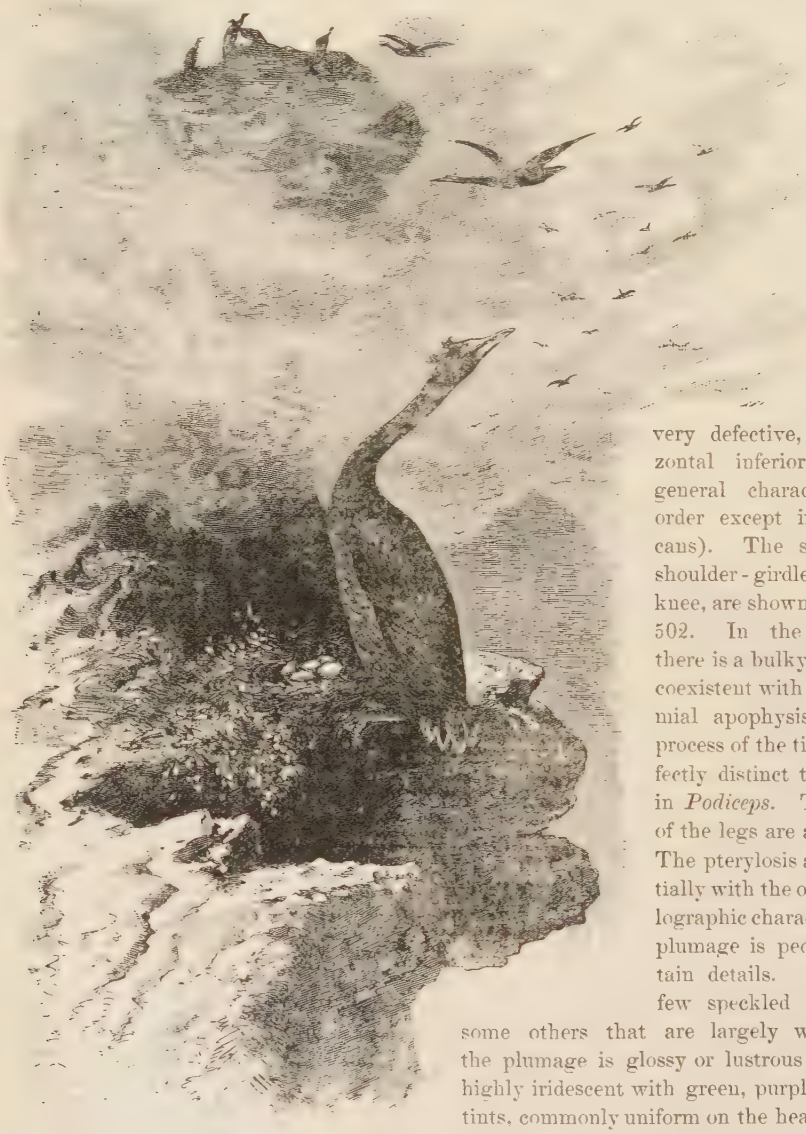


FIG. 503. — The nest of the Cormorant (*P. bicristatus*). (Designed by H. W. Elliot.)

long filamentous feathers (considered by Nitzsch filoplumaceous), on the head and neck, and even, in some cases, on the upper and under parts too. These feathers are commonly white, as

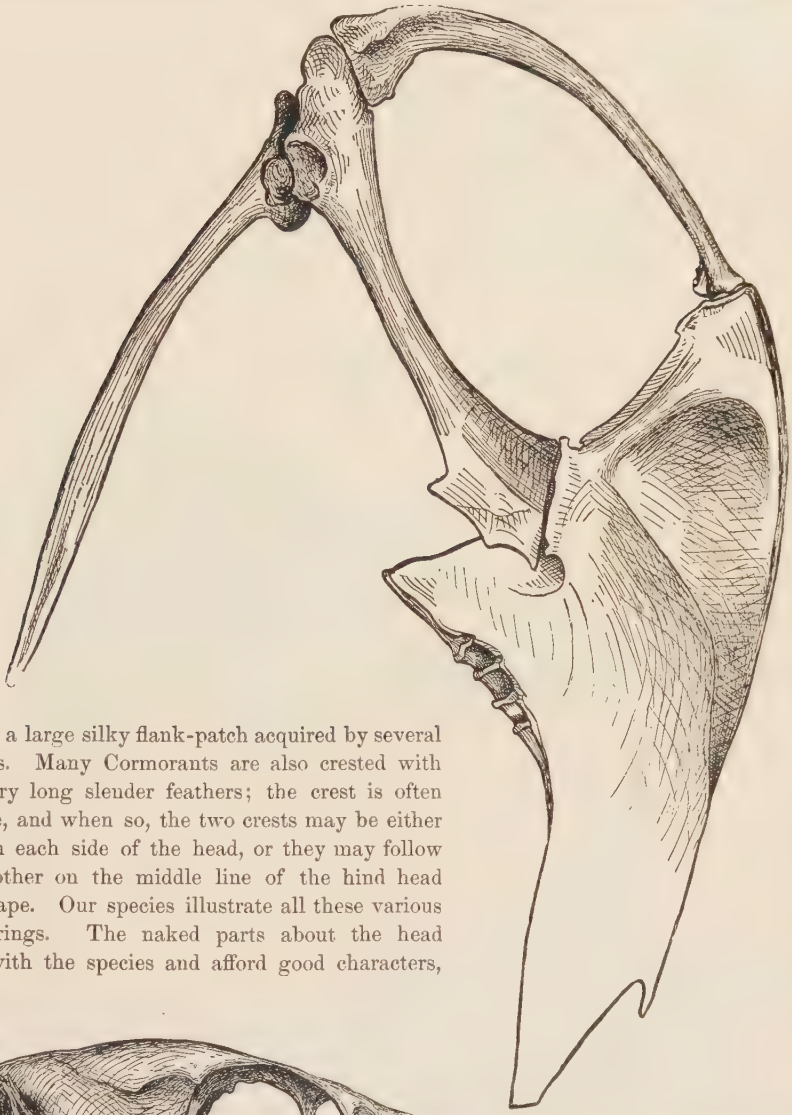


Fig. 504. — Sternum and shoulder-girdle of *Phalacrocorax bicristatus*, nat. size. (From nature by Dr. R. W. Shufeldt.)

is also a large silky flank-patch acquired by several species. Many Cormorants are also crested with ordinary long slender feathers; the crest is often double, and when so, the two crests may be either one on each side of the head, or they may follow each other on the middle line of the hind head and nape. Our species illustrate all these various featherings. The naked parts about the head vary with the species and afford good characters,

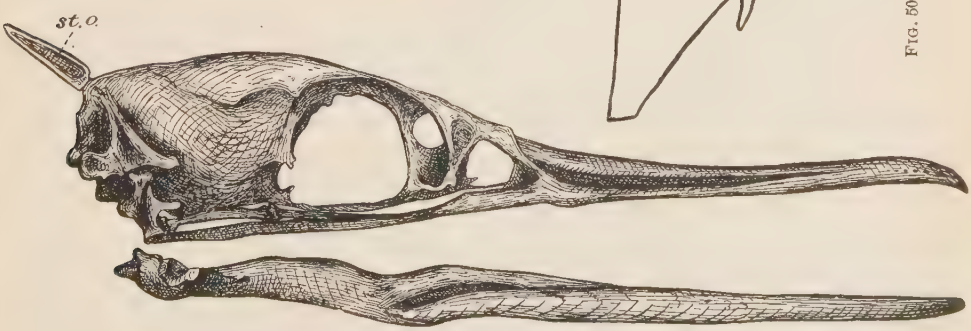


Fig. 505. — Skull of *Phalacrocorax bicristatus*, showing *sto.* occipital style or nuchal bone; nat. size. (From nature by Dr. R. W. Shufeldt. The style is somewhat tilted upward from its natural position.)

especially considering the shape of the pouch: the skin is usually brightly colored, and sometimes carunculate. The eyes, as a rule, are green — a color not common among birds. These birds are highly psilopædic as well as altricial; the young are for some time blind, naked, and perfectly helpless.

Twenty-five species of Cormorants may be considered established. Their study is difficult, owing to the great changes in plumage, the high normal variability in size, and their close inter-relation, which is such that the single genus *Graculus* does not appear capable of well-founded division. Species are found all over the world, excepting the uttermost polar regions, and are usually very abundant in individuals; they are all very much alike in their habits. Many are maritime, but others range over fresh waters as well. They are eminently gregarious, especially in the breeding season, when they congregate by thousands — the boreal kinds generally on rock-begirt coasts and islands, those of warm countries in the dense fringes of shrubbery. They often migrate in large serried ranks. The nest is rude and bulky; the eggs are commonly two or three, of elliptical form and pale greenish color, overlaid with a white chalky substance. The Cormorants feed principally upon fish, and their voracity is proverbial, though probably no greater than that of allied birds. Under some circumstances they show an intelligent docility; witness their semi-domestication by the Chinese, who train them to fish for their masters, a close collar being slipped around the neck to prevent them from swallowing the booty.

303. **PHALACRO'CORAX.** (Gr. φαλακροκόραξ, *phalakrokorax;* Lat. *phalacrocorax*, a cormorant, sea-crow, *corvus marinus*: φαλακρός, *phalakros*, bald, and κόραξ, *korax*, a raven.) CORMORANTS. Character as above said. There appears to be but one genus in the family, but several groups of species may be cited subgenerically. There are three such groups among our species, respectively exemplified by *P. carbo*, *P. dilophus*, and *P. violaceus*.

Analysis of Species.

Tail of 14 feathers.
- Gular sac heart-shaped behind, bordered with white . . . . . *carbo* 750

Tail of 12 feathers.
- Gular sac convex or nearly straight-edged behind.
  - No white border behind gular sac.
    - Lateral crests of curly feathers on sides of head.
      - Largest: length about 36.00. Developing white filaments on head in breeding season. N. W. Coast . . . . . [illegible] 752
      - Medium: length 30.00–33.00. Scarcely or not developing white filaments on head in breeding season. At large . . . . . *dilophus* 751
      - Small: length 30.00 or less. Probably not developing white filaments. S. E. Coast *floridanus* 753
      - Small: size of the last. Developing white filaments. S. W. Coast. . . . *albociliatus* 753a
  - A border of white feathers behind the sac.
    - Very small: length about 24.00 . . . . . *mexicanus* 754
- Gular sac heart-shaped behind. (No lateral crests.)
  - Sac dark-blue, bordered by a fawn-colored gorget. Feathers of back distinct, dark-edged *penicillatus* 755
  - Sac not bordered with a colored gorget. No distinct colored edges of feathers of back
    - Shafts of tail-feathers said to be white . . . . . *perspicillatus* 756
    - Shafts of tail-feathers not white
      - Frontal feathers not reaching bill, which is entirely surrounded with red skin; base of bill blue . . . . . *bicristatus* 757
      - Frontal feathers reaching bill.
        - Larger: wing 10.00 or more . . . . . *violaceus* 758
        - Smaller: wing under 10.00 . . . . . *bairdi* 759

750. **P. car'bo.** (Lat. *carbo*, carbon: from the black color.) COMMON CORMORANT. SHAG. Adult ♂ ♀: Tail of 14 feathers (here only among our species). Gular sac heart-shaped behind. Bill blackish, whitish along edges and at base below. Iris green. Skin about eyes livid greenish, orange under the eye; sac yellow, bordered behind by a gorget of white feathers. General plumage glossy greenish-black; feathers of back and wing-coverts distinct

bronzy-gray, black-edged; quills and tail grayish-black; feet black. In summer, when breeding, a white flank-patch, numerous long thready white plumes scattered on head and neck, and a small black occipital and nuchal crest. Length 36.00; extent 60.00; wing 12.00–14.00; tail 6.00–7.00; tarsus over 2.00; bill 3.40 along ridge, 4.00 along the gape. In winter no crests or white feathers on neck or flanks. Young: Bill grayish-brown, black on top and at tip; bare skin and sac yellow. Top of head and hind neck brownish-black; back and wing-coverts brownish-gray, the feathers with dark margins, some of them also edged finally with whitish. Throat brownish-white, and under parts generally whitish, blackish along the sides, dusky under the wings and across lower belly. The naked young in the nest are unpleasant livid purplish objects, with protuberant bellies, and large feet; the first down is blackish. Eggs 3, sometimes 4, bluish-green coated with white chalky substance, 2.60 × 1.75; nests of sticks, moss, and seaweeds, very filthy and offensive. Atlantic Coast of Europe and North America; breeds in great numbers on the rocky shores of Labrador and Newfoundland; S. to the Middle States in winter.

751. P. dilo/phus. (Gr. *δίς*, *dis*, twice; *λόφος*, *lophos*, crest. Fig. 506.) DOUBLE-CRESTED CORMORANT. Tail of 12 feathers. Gular sac convex behind. No colored gorget. Glossy

FIG. 506. — Double-crested Cormorant, nat. size. (Ad nat. del. E. C.)

greenish-black; feathers of the back and wings coppery-gray, black-shafted, black-edged. Adult with curly black lateral crests in the breeding season, but few if any other filamentous white ones, over the eyes and along the sides of the neck; white flank-patch not observed in any specimens examined, probably not occurring; iris green; gular sac and lores orange. Winter spec. with bill bright yellow, blackening along culmen, gular sac red anteriorly, ochrey-yellow posteriorly; legs dull black. Length 30.00–33.00 inches; extent 50.00; wing 12.00–13.00; tail 6.00–7.00; bill along gape 3.50; tarsus a little over 2.00. Young: Plain dark brown, paler or grayish (even white on the breast) below, without head-plumes. N. Am., at large, the commonest species, the only one diffused over the interior; eggs 3–4, 2.50 × 1.55.

752. P. d. cincinna/tus. (Lat. *cincinnatus*, having curly hair.) WHITE-TUFTED CORMORANT. General character of the preceding, of which it appears to be a large northern variety. *White* lateral crests, of a superciliary bundle of long curly filamentous feathers. Larger: size of *P. carbo*. Alaska.

753. P. d. flori/da/nus. FLORIDA CORMORANT. Similar to, smaller than *P. dilophus*. Length 30.00 or less; extent 45.00; wing 12.00 or less; tail 6.00 or less; tarsus a little under 2.00; but bill as large if not larger; gape nearly 4.00. The plumage is exactly the same. There are said to be certain differences in the life-colors of the bills (blue instead of yellow on under mandible and edges of upper — Audubon), but none show in my specimens. This is simply a localized southern race of *dilophus*, smaller in general dimensions, with relatively larger bill.

as usual in such cases; the sac seems to be more extensively denuded. Resident on the Floridan and Gulf coast, breeding by thousands on the mangrove bushes; in summer, ranging up the Mississippi valley to Ohio, and along the coast to North Carolina.

753a. **P. d. albocilia'tus**. (Ridgw. MS.) Small: like *floridanus*, but with *white* nuptial crests as in *cincinnatus*. Pacific coast, breed from the Farallone Islands to Cape St. Lucas.

754. **P. mexica'nus**. Mexican Cormorant. Resembling the last; lustre more intense, rather violet-purplish than green; long filamentous white feathers on head and neck (but no definite black lateral crests?); sac orange, white-edged with feathers. Small: length about 24.00; extent 40.00; wing about 10.00; tail 6.00–6.50, thus relatively long; tarsus under 2.00; gape of bill under 3.00. The sac is not strongly convex in outline behind, the feathers passing across in a straight or even convex line. Central America and West Indies; Texas; up the Mississippi to Illinois and Kansas.

755. **P. penicilla'tus**. (Lat. *penicillatus*, pencilled, brushy.) Tufted Cormorant. Brandt's Cormorant. Deep lustrous green, changing to violet or steel-blue on the neck; the back proper like the under parts, but the scapulars and wing-coverts showing narrow dark edgings of the individual feathers (much less conspicuous than in any of the foregoing species; nothing of the sort is seen in any of the following ones). Sac dark blue, surrounded by a gorget of fawn-colored or mouse-brown plumage; heart-shaped behind, owing to a narrow pointed forward extension of the feathers on the middle line, as in *P. carbo*, but largely naked, the feathers extending on it little if any in advance of those on the lower mandible. White filamentous plumes, 2 inches or more long, straight and stiffish, spring in a series down each side of the neck; a few others are irregularly scattered over the back of the neck; many others, still longer, grow on the upper part of the back. No black crests, nor white flank-patch, observed. Wing nearly 12.00; tail scarcely or not 6.00, thus relatively very short; bill along culmen 2.75; tarsus 2.50. Does not particularly resemble any other species here described. Young: Blackish-brown, rustier below, the belly grayish; scapulars and wing-coverts with edges of the feathers paler than the centres; gorget fawn-colored, as in the adult (*P. townsendii!* Aud.). Pacific Coast, U. S., common.

756. **P. perspicilla'tus**. (Lat. *perspicillatus*, conspicuous, spectacular.) Pallas' Cormorant. Deep lustrous green, above and below, with blue gloss on the neck, and rich purplish on the scapulars and wing-coverts, the dorsal feathers not sharp-edged nor bordered, as in all the foregoing. Shafts of tail-feathers (said to be) white; if this holds, it is a unique character among our species. Adult with coronal and occipital crests (not lateral paired crests); a white flank-patch in the breeding season; face and neck with long sparse straw-yellow plumes; sac orange, heart-shaped; bill blackish. Large: length 36.00; wing 13.00; tail 7.00? 9.00? tarsus 3.00; bill (along gape?) 4.00, very stout, two-thirds of an inch deep at base. N. Pacific Coast. I have not seen this species, which seems to be well marked. There are no known specimens in this country, and none of the ornithologists who have lately visited Alaskan shores have found the bird.

757. **P. bicrista'tus.** (Lat. *bicristatus*, twice-crested. Figs. 502, 503, 504, 505.) Red-faced Cormorant. Frontal feathers not reaching base of the culmen, the bill being entirely surrounded by naked *red* skin which also encircles the eyes, somewhat carunculate, forming a kind of wattle on each side of the chin; base of under mandible *blue;* feet black, blotched with yellow. Crown with a median bronzy black crest, and nape with another, in the same line. In the specimens examined, a large white flank-patch, but few if any white plumes on neck. Plumage richly iridescent, mostly green, but violet and steel-blue on the neck, purplish, violet, and bronzy on the back and wings, the feathers there without definite dark edgings. Length 33.00; extent 48.00; wing 12.00; tarsus 2.97; gape of bill 3.00. Alaska, both on the coast and islands; swarming on the Seal Islands of Behring's Sea, where resident. Nests on the rocky cliffs; habits in all respects those of other species. Eggs as usual 3–4, 2.50 × 1.50.

758. **P. viola'ceus.** (Lat. *violaceus*, violet.) VIOLET-GREEN CORMORANT. Frontal feathers reaching culmen; gular sac inconspicuous, very extensively feathered, the feathers reaching on the sides of the under mandible to below the eyes, and running in a point on the sac far in advance of this. Small: length 24.00–28.00; extent about 40.00; wing 10.00–11.00; tail 6.00 or less; tarsus 2.00 or less; bill along gape 3.00 or less, very slender, and smooth on the sides, its depth at base about 0.33. Deep lustrous green, including the back, the feathers of which are not margined; the scapulars, wing-coverts, and sides of the body iridescent with purplish or coppery, the neck with rich violet and blue; gular sac orange; feet black. Two median lengthwise crests as in the last two species. Among the specimens before me, one has no white flank-patch, but a few white scattered plumes on the neck; another, marked ♀, has none of these, but a large snowy tuft on the flanks. Pacific Coast of N. Am., very abundant in suitable places along the Alaskan coast; breeding on cliffs. (*P. resplendens*, Aud.)

759. **P. v. bair'di.** (To S. F. Baird.) BAIRD'S CORMORANT. Like the last; very small, the wing being under 10.00, the tarsus 1.67, the gape 2.67; the bill extremely slender. Has both the flank-tufts and the neck-plumes; the sac in life said to be dusky studded with red. Possibly represents a small southern race, bearing somewhat the relation to *violaceus* that *floridanus* does to *dilophus*. Farallone Islands, Cala.

56. Family PLOTIDÆ: Darters.

Bill about twice as long as the head, straight, slender, very acute, paragnathous, the tomia with fine serratures. Gular sac moderate, naked. Nostrils minute, entirely obliterated in the adult. Wings moderate, the 3d quill longest. Tail rather long, stiff, broad and fan-shaped, of 12 feathers widening towards the end, the outer web of the middle pair curiously crimped (in our species).

There is an occipital style, as in cormorants, but it is very small. There are remarkable peculiarities of the cervical vertebræ, in their conformation and articulation, the passage of tendons through bony eyelets, etc., — a mechanism producing the strong kink observable near the middle of the neck, and the ability of the bird to thrust forward and retract the head. There are 20 cervical vertebræ in *P. anhinga*. The digestive system shows a remarkable feature; instead of the lower part of the œsophagus being occupied by the proventricular glands, these are placed in a small distinct sac on the right side of the gizzard, which, as in other *Steganopodes*, develops a special pyloric cavity, the orifice of which "is protected by a mat of lengthy hair-like processes, much like cocoa-nut fibre, which nearly half fills the second stomach." There is a single small cœcum, as in herons. The tongue is very rudimentary. The carotid is single in *P. anhinga*. Sternum as in Cormorants.

The darters are birds of singular appearance, somewhat like a cormorant, but much more slightly built, and with exceedingly long slender neck and small constricted head that seems to taper directly into the bill, the head, neck, and bill resembling those of a heron. As in the Cormorants, there are long slender feathers on the neck; the sexes are commonly distinguishable, but the ♀ is said sometimes to resemble the ♂. Other changes of plumage appear to be considerable, but not well made out. The feet are short, and placed rather far back, but the birds perch with ease. Unlike most of the order, they are not maritime, shunning the seacoast, dwelling in the most impenetrable swamps of warm countries. They fly swiftly, and dive with amazing ease and celerity. They are timid and vigilant birds; when alarmed they drop from their perch into the water below, noiselessly and with scarcely a ripple of the surface, and swim beneath the surface to a safe distance before reappearing. When surprised on the water, they have the curious habit of sinking quietly backward, like grebes; and they often swim with the body submerged, only the head and neck in sight, looking like some strange kind of water serpent. They feed on fish, which they do not dive down upon,

but dive for and pursue under water like cormorants and loons. The eggs are three or four, pale bluish, with white chalky incrustation. There are only three or four species: the African *P. levaillanti;* the *P. melanogaster* of Southern Asia, with the Australian *P. novæhollandiæ*, if distinct from the last; with the following:

304. **PLOTUS.** (Gr. πλωτός, *plotos*, swimming well.) DARTERS. Character as above.

760. **P. anhin'ga.** (Portuguese *anhina*, Lat. *anguina*, snaky.) DARTER. ANHINGA. SNAKE-BIRD. WATER-TURKEY. ♂: Glossy greenish-black; a broad silver gray wing-band formed by most of the coverts; lower neck behind spotted, and scapulars and tertiaries striped with silvery-gray; tail pale-tipped; filamentous feathers of neck purplish-ash. ♀: with parts of the head, neck, and back brown, the jugulum and breast fawn-color sharply margined with rich brown. Bill yellow, dusky-greenish on the ridge and tip; sac orange; eye-space livid; eye carmine; feet dusky and yellow. Length about 36.00; extent nearly 4.00 feet; wing 13.00–14.00; tail 10.00–11.00; bill 3.25 along culmen; tarsus 1.33. S. Atlantic and Gulf States, common; in summer to North Carolina, and up the Mississippi to Illinois and Kansas; New Mexico. Nest bulky, placed on trees and bushes over the water, of sticks, leaves, roots, moss, etc.; eggs 3–4, like cormorant eggs in color and texture, but narrow and elongate, 2.60 × 1.25. Young with buff-colored or white woolly down. Fed in the nest by regurgitation, like cormorants.

57. Family TACHYPETIDÆ: Frigates.

FIG. 507. — Frigate, with Tropic Bird in the distance. (From Michelet.)

Bill longer than the head, epignathous, stout, straight, wider than high at the base, thence gradually compressed to the strongly hooked extremity, where the under as well as upper mandible is decurved. Nostrils very small, linear, almost entirely closed, in a long narrow groove. Gular sac small, but capable of considerable distension. Wings exceedingly long and pointed, of about 34 remiges, of which the 10 primaries are very powerful, with stout quadrangular shafts; upper and middle portion of the wings greatly lengthened. Tail very long, deeply forked, of 12 strong feathers. Feet exceedingly small, the tarsus, in particular, extraordinarily short, feathered; webbing restricted, that between inner and next toe very slight; middle claw pectinate. Bulk of body slight compared with the great length of the wings and tail. Here only in this order is found the

os uncinatum, a peculiar skull-bone occurring in nearly all the petrels, the turacous (*Musophagidæ*), and many cuckoos; and here only the stomach develops no pyloric cavity. Cœca 2, but very small. Sternum very broad for its length, the furculum firmly anchylosed, the posterior border entire. The femoro-caudal and ambiens are present; the accessory femoro-caudal, semitendinosus, and its accessory are absent.

The frigates are maritime and pelagic birds of most warm parts of the globe. Their general contour is unique among water-birds, in the immense length and sweep of the wings, length of the forked tail and extreme smallness of the feet. In command of wing they are unsurpassed, and but few birds approach them in this respect. They are more nearly independent of land than any other birds excepting albatrosses and petrels, being often seen hundreds of miles at sea, and delight to soar at an astonishing elevation. They cannot dive, and scarcely swim or walk; food is procured by dashing down on wing with unerring aim, and by harassing gulls, terns, and other less active or weaker birds until they are forced to disgorge or drop their prey. Their habit is gregarious, especially during the breeding season, when thousands congregate to nest in low thick bushes by the water's edge. The nest is a shallow flat structure of sticks; the eggs, two or three in number, are greenish-white with a thick smooth shell. "The young are covered with yellowish-white down, and look at first as if they had no feet. They are fed by regurgitation, but grow tardily, and do not leave the nest until they are able to follow their parents on wing." The following is the principal if not the only species.

FIG. 508. — Gular pouch of Frigate.

305. **TACHY'PETES**. (Gr. *ταχυπέτης*, *tachupetes*, flying rapidly.) FRIGATES. Character as above.

761. **T. a'quilus**. (Lat. *aquilus*, dark, swarthy. Figs. 507, 508.) FRIGATE. MAN-OF-WAR BIRD. ♂ brownish-black, glossed with green or purplish, duller on the belly, wings showing brown and gray; ♀ with white on neck and breast. Length about 3.50 feet; extent 7.00–8.00; wing 2.00; tail 1.50; bill 5 or 6 inches; tarsi 1 inch or less! S. Atlantic and Gulf Coast. Eggs 2–3, 2.90 × 2.00.

58. Family PHAËTHONTIDÆ: Tropic Birds.

Bill about as long as the head, stout, straight, compressed, tapering, acute, paragnathous. Gular sac rudimentary, almost completely feathered. Nostrils small, linear, but remaining patulous. Tail with the two middle feathers in the adult filamentous and extraordinarily prolonged, the rest short and broad. Among anatomical characters it is to be noted that the muscles of the leg are as in *Laridæ*, as might be expected from the outward resemblance of these birds to terns; they having the accessory semitendinosus, lacking in other families of the order.

The tropic bird resembles a large stout tern in general figure; the bill, especially, being almost exactly like that of a tern. The principal external peculiarity is the development of the middle tail-feathers; the feathering of the gular sac and the permanent patulance of the nostrils are other features. They are graceful birds on the wing, capable of protracted flight, venturing far from land. They are gregarious at all times, and nest in communities along coasts and on islands, in rocky places or among low trees and bushes. As implied in their name, they are birds of the torrid zone, though in their extensive wanderings they visit Southern seas, and have even been reported from beyond latitude 49° N. There are but three well-determined species: *P. flavirostris*, *P. æthereus*, and *P. rubricauda*.

306. **PHAËTHON**. (Gr. Φαέθων, *Phaëthon*, son of the sun.) TROPIC BIRDS. Character as above.

762. **P. æthe'reus**. (Lat. *æthereus*, pertaining to the upper air.) RED-BILLED TROPIC BIRD. Bill red; tarsi and part of toes light colored; rest of toes black. Plumage pure white, on nearly all the upper parts finely barred with black; black markings on sides under wings; a transocular fascia, outer webs and part of inner webs of most of the primaries, most of several inner secondaries, and most of the shafts of the tail-feathers, black, the shafts of the long middle pair, however, white in most of their extent. Length about 36.00 inches, including the long tail-feathers; without these, about 18.00; wing 12.00; long middle tail-feathers up to 18.00; tarsus 1.00; middle toe and claw 1.75; bill 2.50 along culmen, nearly 1.00 deep at base. Tropical and subtropical America, accidental in N. Am.; said to have straggled to Newfoundland in one instance (*Freke*, Pr. Roy. Soc. Dublin, 1879)

763. **P. flaviros'tris**. (Lat. *flavirostris*, yellow-billed.) YELLOW-BILLED TROPIC BIRD. Bill and tarsi yellow; toes black. Plumage white, tinged with salmon or rosy on the under parts and long tail-feathers; lacking the barring with black of the last species, but with definite black areas — a transocular fascia, an oblique band on lesser wing-coverts and thence on scapulars and inner secondaries, shaft-stripes on outer five or six primaries, stripes on the flanks, and most of the shafts of the tail-feathers, including the middle pair. Smaller than the last; development of middle tail-feathers about the same; wing 11.00; bill notably smaller, only about 2.00 along culmen and 0.75 deep at base. This is the species figured by Audubon (8vo, pl. 427) under the wrong name of *P. æthereus*, which belongs to the foregoing. Tropical and subtropical America, rare or casual in the U. S., as on the Gulf coast. Has strayed to Western New York in one instance (*Coues*, Bull. Nutt. Club, v, 1880, p. 63).

XII. Order LONGIPENNES: Long-winged Swimmers.

Long-winged Natatores with open nostrils and small free or no hind toe. — Wings long, pointed, reaching when closed beyond the base, in many cases beyond the end, of the tail, which is usually lengthened and of less than 20 rectrices (oftenest 12). Legs more or less perfectly beneath centre of equilibrium when the body is in the horizontal position; the crura more nearly free from the body than in other *Natatores*, if not completely external. Anterior toes palmate; hallux never united with the inner toe, highly elevated, directly posterior, very small, rudimentary, or absent; tibiæ naked below. Bill of variable form, but never extensively membranous nor lamellate, the covering horny throughout, sometimes discontinuous. Nostrils variable, but never abortive. No gular pouch. Altricial.

This order, which may be recognized among web-footed birds by the foregoing external characters, is less substantially put together than either of the two preceding, — not that its components are not sufficiently related to each other, but because the essential points of structure are shared to a considerable extent by other groups. Thus the osteological resemblances of longipennine birds with loons, auks, and plover, are quite close, while the digestive system agrees in general characters with that of other fish-eating birds. In some of the lower members of the order, the tibia develops an apophysis, as in the loons; while even in external characters, one genus at least (*Halodroma*) resembles the *Alcidæ*. It is not certain that the order must not be broken up, or rather enlarged and differently defined, to include some of the genera now ranged under *Pygopodes*.

The palate has the schizognathous structure; "the maxillo-palatines are usually lamellar and concavo-convex, but in the *Procellariidæ* they become tumid and spongy" (*Huxley*); basypterygoid processes may be wanting, but they are certainly present in many cases. The nasal bones are schizorhinal in *Laridæ*, holorhinal in *Procellariidæ*. There is apparently one pair of syringeal muscles throughout the order. The œsophagus is capacious and distensible; there is no special crop; the proventiculus is a bulging of the gullet; the gizzard is small and

little muscular; the cæca are variable; the cloaca is large. Certain genera offer peculiarities of this general type of alimentary canal. According to Nitzsch, the pterylosis of the gulls "approaches very closely that of the *Scolopacidæ*, and can hardly be distinguished therefrom with certainty by any character." In the terns, "in consequence of the slender and elegant form of the body, the tracts are very narrow, and perfectly scolopacine." The jägers differ "in having the outer branch of the inferior tract united with the main stem in the first part of its course, and all the tracts still broader and stronger than in" the gulls; while in the petrels, "the tract formation of the jägers is elevated into the type of a group, undergoing scarcely any change in the form of the inferior tract, but showing some little modification of the dorsal tract."

As here constituted, the order embraces two superfamilies or suborders, to be known by the character of the nostrils; both are well represented in this country, where occur all the leading genera excepting *Halodroma*.

19. Suborder GAVIÆ: Slit-nosed Longwings.

The character of this group is the same as that of its single

59. Family LARIDÆ. Gulls, Terns, etc.

Nostrils not tubular (linear, linear-oblong, oval or drop-shaped), sub-basal or median, lateral, pervious. The hallux, though very small and elevated, with its tip hardly touching the ground, is, except in *Rissa*, better developed than in the petrels. The habitat is fluviatile, lacustrine and maritime, rather than pelagic. The family contains four leading genera, each of which may be assumed as the basis of a subfamily; all four occur in North America. Fuller characters are: Bill of moderate length, entire, or furnished with a cere, the upper mandible longer than, as long as, or shorter than the under; the culmen convex; the commissure very large, the cutting edges without lamellæ, the symphysis of the inferior mandibular rami complete for a considerable distance, an eminence being formed at their junction. No gular sac. Feathers usually extending farther on the sides of the upper mandible than on the culmen, and farther between the rami than on the sides of the under mandible. Nostrils linear or oval; direct, pervious, lateral, opening on the basal half of the bill. Eyes of moderate size, placed about over the angle of the mouth. Wings long, broad, strong, pointed, with little or no concavity. Primaries very long, more or less acute, the first longest, the rest rapidly graduated. Secondaries numerous, short, broad, with rounded or excised tips. Tertials of moderate length, straight, rather stiff. Legs placed well forward on the abdomen, more or less perfectly ambulatorial. Thighs entirely covered and concealed. Tibiæ projecting; feathered above; a considerable portion below naked, covered with more or less dense, sometimes reticulated, skin. Tarsi of moderate length or rather short; compressed; rather slender; anteriorly transversely scutellate, posteriorly and laterally reticulate. Anterior toes of moderate length, the middle usually about equal to the tarsus; the outer shorter than the middle, intermediate between it and the inner; scutellate superiorly; all of normal number of segments (3, 4, 5). Hallux present; very small, short, elevated above the plane of the other toes; entirely free and disconnected; of the normal number of segments (2) — except in *Rissa*. Webs broad and full, extending to the claws; their surfaces finely reticulated, their edges usually more or less incised, sometimes rounded. Claws fully developed, compressed, curved, more or less acute, the edge of the middle dilated, but not serrated. Tail very variable. Body generally rather full, and sometimes slender. Neck rather long. Head of moderate size. Plumage soft, close, thick; its colors simple — white, black, brown, or pearl-blue predominating; bright tints hardly found, except on the bill or feet, or as a temporary condition; the sexes alike in color, but the plumage varying greatly with age and season. Eggs generally three, light-colored, with numerous

heavy dark blotches. Nidification normally terrestrial: reproduction altricial: young ptilopædic.

Analysis of Subfamilies.

Bill epignathous, cered. (Jägers) . . . . . LESTRIDINÆ
Bill epignathous, not cered. (Gulls) . . . . . LARINÆ
Bill paragnathous. (Terns) . . . . . STERNINÆ
Bill hypognathous. (Skimmers) . . . . . RHYNCHOPINÆ

70. Subfamily LESTRIDINÆ: Jägers, or Skua Gulls.

Covering of bill discontinuous, the upper mandible being saddled with a large horny "cere," beneath the edges of which the nostrils open (unique, among water-birds); bill epignathous. Tail nearly square, but the middle pair of feathers abruptly long-exserted. Feet strong; tibiæ naked below, the podotheca granular or otherwise roughened behind, scutellate in front; webs full; claws large, curved, acute. Certain pterylographic characters have been already noted. A leading anatomical peculiarity in the large size of the cœca, as compared with the cases of the other subfamilies. Another is that the sternum is single-notched behind, there being two notches on each side in the other subfamilies. There is but one genus, and only four species are well determined. They belong more particularly to the northern hemisphere, although some also inhabit southern seas; they mostly breed in boreal regions, but wander extensively at other seasons. They inhabit sea coasts, and also large inland waters; the nidification resembles that of the gulls; eggs 2–3, dark-colored, variegated. The sexes are alike; the young different, excepting one species; there is also a particular melanotic plumage, apparently a normal special condition. At first the central tail-feathers do not project, and they grow tardily. The skua gulls are eminently rapacious, whence their name of "jäger" (hunter); they habitually attack and harass terns and the smaller gulls, until these weaker and less spirited birds are forced to drop or disgorge their prey. Their flight is vigorous; lashing the air with the long tail, they are able to accomplish the rapid and varied evolutions required for the successful practice of piracy. Thus in their leading traits they are marine Raptores; whilst the cered bill furnishes a curious analogy to the true birds of prey.

307. **STERCORA'RIUS.** (Lat. *stercorarius*, a scavenger.) JÄGERS. Character of the subfamily, as above. The species of *Megalestris* differs decidedly from the rest, and might form a genus apart.

Analysis of Species

Bill shorter than middle toe without claw; tarsus shorter than middle toe and claw; central rectrices little projecting, broad to the tip. (*Megalestris.*)
Of great size, and robust form. Bill about 2 inches long . . . . . *skua* 764
Smaller; bill and tarsi relatively longer than in the foregoing, latter not shorter than middle toe and claw; central rectrices finally projecting far beyond the rest.
Central rectrices projecting about 4 inches, broad to the end . . . . . *pomatorhinus* 765
Central rectrices projecting about 4 inches, acuminate . . . . . *parasiticus* 766
Central rectrices projecting 8-10 inches, acuminate . . . . . [illegible] 767

764. **S. ska'a.** (Færoëse name.) SKUA. Bill shorter than the middle toe without the claw; exceedingly robust: width at base about equal to the height, which is a third of the length of culmen. Striæ and sulci numerous and well marked. Encroachment of feathers on bill moderate, and nearly the same on both mandibles. Occiput scarcely crested. Wings only moderately long for this subfamily; the primaries very broad, and rounded at their tips. Tail very short, broad, nearly even, the feathers truncated; central pair projecting but little, and broad to their very tips, which are also truncated. Feet large and stout: tarsi shorter than the middle toe and claw. Size large: form robust and heavy: general organization very powerful. Colors much the same over the whole body; not subject to any very remarkable changes with age, sex, or season. Adult ♂ ♀: Latero-nuchal feathers elongated, rigid, with long disconnected fibrillæ. Above, blackish-brown, more or less variegated with chestnut and

whitish; each feather being dark-colored, with a spot of chestnut toward its extremity, which in turn fades into whitish along the shaft toward the tip of each feather. On the latero-nuchal region and across the throat the chestnut lightens into a decided reddish-yellow, the white being as a well-defined, narrow, longitudinal streak on each feather. The crown, post-ocular, and mental region have but little whitish. Inferiorly the plumage is of a blended fusco-rufous, lighter than on the dorsum, with a peculiar indefinite plumbeous shade. The wings and tail are blackish; their shafts white, except toward the tips; the remiges and rectrices white for some distance from the bases. This white on the tail is concealed by the long tail-coverts, but appears on the outer primaries as a conspicuous spot. Bill and claws blackish-horn; feet black. Bill from base to tip 2.10; to end of cere 1.20; gape 3.00; height at base 0.75; width a little less; gonys 0.50; wing 16.00; tail 6.00; tarsus 2.70; middle toe and claw 3.10. Young-of-the-year: The size much less, bill weaker and slenderer; cere illy developed; striæ not apparent, and its ridges and angles all want sharpness of definition. Wings short and rounded, the quills having very different proportional length from those of the adults; the 2d being longest, the 3d next and but little shorter; the 1st about equal to the 4th. The inner or longest secondaries reach, when the wing is folded, to within an inch or so of the tip of the longest primary. Central rectrices, if anything, a little shorter than the next. Colors generally as in the adult, but everywhere duller and more blended, having few or no white spots; the reddish spots dull, numerous, and large, especially along the edge of the forearm and on the least and lesser coverts. On the under parts the colors are lighter, duller, and still more blended than above. The prevailing tint is a light, dull rufous, most marked on the abdomen; but there and elsewhere more or less obscured with an ashy or plumbeous hue. The primaries, secondaries, and tertials, together with the rectrices, are dull brownish-black; their shafts yellowish-white, darker terminally. At the bases of the primaries there exists the ordinary large white space, but it is more restricted than in the adults, and so much hidden by the bastard quills that it is hardly apparent on the outside of the wing, though very conspicuous on the inferior surface. Legs and feet parti-colored, — brownish-black, variegated with yellowish. Bill along culmen 1.75; along gape 2.75; height at base 0.50; length of gonys 0.35; tarsus 2.60; middle toe and claw the same; wing 12.25; tail 5.75. N. Am., northerly, rare or casual. "California."

765. S. pomatorhi'nus. (Gr. *πῶμα, πώματος, poma, pomatos*, a flap, lid; *ῥίς, ῥινός, hris, hrinos*, nose.) POMATORHINE JÄGER. Adults, breeding plumage: Bill shorter than the head, or ¾ the tarsus, about 2½ times its own height at the base; width about the same as the height. Tail somewhat less than half the wing. 1st primary but little surpassing the 2d. Occiput subcrested. Feathers of the neck rigid and acuminate, their fibrillæ disconnected. Tail-feathers, including the central, broad quite to their tips, which are truncated, the rhachis projecting as a small mucro. The central pair project about 3 inches; are broad to near the tip, where they form an angle of 45° with the rhachis; their fibrillæ exceedingly long (2¾ inches), while those of the lateral feathers are only 1¾. Tail slightly graduated. Tibiæ bare for ⅜ of an inch, scutellate for ½ inch. Tarsi very rough; anteriorly covered with a single row of scutella, except toward the tibio-tarsal articulation, where these scutella gradually degenerate into small, irregular polygonal plates, with which the whole of the rest of the tarsus is reticulated. These plates largest on the sides of the tarsus externally; on the heel-joint, and posterior aspect of the tarsus generally, they become raised into small conical pyramids, acutely pointed. The scutella of the anterior portion of the tarsus are continuous with the superior surface of the toes, while the polygonal reticulation occupies both surfaces of the webs, and the inferior surface of the toes. Hallux extremely short, its nail stout, conical at the base, acute, little curved. Anterior claws all very strong and sharp; inner most so; the middle expanded on its inferior edge, not serrated. Webs broad, full, unincised, their free margins a little convex. The "cere" has a straight, smooth, convex culmen; its inferior

border curves gently upward to give passage to the nostrils. The union of the two lateral halves leaves a well-marked acutely-angular recess over the culmen. There is a well-marked lateral longitudinal groove. Curve of nail regular, gradual. Commissure straight to the nostrils, then gradually declinato-convex. Eminentia symphysis slightly marked; commissure long, gonys short, a little concave, gape wide. Outline of feathers on the bill much as in the *Larinæ*, but supero-laterally they do not run so far forward, nor with so acute an angle. Nostrils placed far forward, lateral, linear, direct, pervious, their opening a little club-shaped. Bill horn, deepening into black; feet black. Pileum and occipital crest brownish-black; this color extending much below the eyes, and occupying the feathers on the ramus of the inferior maxilla. Acuminate feathers of the neck light yellow. Back, wings, tail, upper wing-coverts, under tail-coverts as far as the flanks, deep blackish-brown. Under parts, from chin to abdomen, and neck all round (except the acuminate feathers), pure white. Length about 20.00; extent 48.00; wing 14.00; bill 1.75; tarsus 2.00. Nearly adult: Generally as in the preceding, but with a row of brown spots across the breast; the sides under the wings transversely barred with white and brown; the purity of the dark color of the abdomen interrupted by some touches of white. The legs wholly black, and the tail-feathers projecting as much as in the fully adult. Intermediate stage: The band of dark spots across the breast is widened and enlarged, so that the whole breast appears brown, mottled with white; the sides under the wings are conspicuously barred with white and brown; the white of the under parts is continued down over the abdomen to the under tail-coverts; the pure brown of these parts which obtains in the adult now only appearing as transverse bars among the white. Upper tail-coverts and some of the wing-coverts barred with white. Bases of primaries inferiorly white. Central tail-feathers only project an inch. Tarsi irregularly blotched with chrome-yellow — the hind toe and nail being of this color. Young-of-the-year: Bill much smaller and weaker than in the adult, light-colored to beyond the nostrils, when it becomes brownish-black. Feet and toes mostly bright yellow, the terminal portions of the latter black. The whole body everywhere transversely waved with dull rufous. On the head, neck, and under parts, this rufous forms the predominating color; and the bands are exceedingly numerous, of about the same width as the intervening dark color. On the flanks and under tail-coverts the bars become wider, and almost white in color. On the back and wing-coverts the brownish-black is the predominating color; and if any rufous is present, it is merely as narrow edging of the feathers. Quills and tail-feathers brownish-black, darker at tips; whitish toward bases of primaries on inner webs. Light rufous predominating on head and neck; a dusky spot before eye. All the above stages traceable from one to another. Dusky state: The bird is very nearly *unicolor;* blackish-brown all over; this color deepening into quite black on the pileum; lightening into fuliginous-brown on the abdomen, with a slight gilding of the black on the sides of the neck. The whitish bases of the primaries exist. The feet are in the chromo-variegated condition. The central tail-feathers scarcely project half an inch. N. N. Am., ranging to the Middle States in winter; not common.

766. **S. parasi'ticus.** (Lat. *parasiticus*, parasitic.) PARASITIC JÄGER. Adult, breeding plumage: Bill much shorter than head or tarsus; as high as broad at the base. Culmen broad, flattened, scarcely appreciably convex to the unguis, which is moderately convex. Rami very long; gonys very short; both somewhat concave in outline. Eminentia symphysis small but well-marked. Tomia of superior mandible at first ascending and a little concave; then descending and a little convex; very concave toward the tip. Cere without oblique striæ; with a straight longitudinal sulcus on each side of the culmen. Feathers extending far on superior mandible, with a curved free outline, so broad that the feathers of the sides meet over the culmen. Feathers on lower mandible also projecting considerably, almost filling the triangular sulcus on the side as well as the angular space between the rami. Wings moderately long, strong, pointed; first primary much the longest; rest regularly and rapidly graduated;

all rather narrow and tapering to an acute apex, somewhat rigid and falcate. Secondaries short and inconspicuous; broad, the tips of the outer ones nearly square, of the inner obliquely incised, the apex being formed by the inner web alone. Tertials long, soft, flexible. Tail moderately long, contained not quite two and a half times in the wing; very slightly rounded, the graduation being only half an inch. Feathers moderately broad quite to their tips, which are truncated. The central pair project *three* to *four* inches. They begin to taper about four inches from their apices, and regularly converge to a very acute tip. Feet rather short and quite slender; tarsi as long as the middle toe and claw. Tibia naked half an inch above the joint. The scutellation and reticulation is the same as that already described, but the nails are weaker and less arched, though fully as acute. A decided occipital crest and a calotte. Nuchal region with the feathers acuminate and rigid, with loosened fibrillæ. Pileum, occipital crest, and whole upper parts deep brownish-black, with a somewhat slaty tinge, and a slight but appreciable metallic shade; this color deepening into quite black on the wings and tail. Rhachides of primaries and rectrices whitish, except at their tips; the inner vanes albescent baso-internally. Chin, throat, sides of head, neck all round, and under parts to the vent, pure white; the feathers of the latero-nuchal region rigid, acuminate, with disconnected fibrillæ, light yellow. Under tail-coverts like the upper parts, but somewhat of a fuliginous tint; the line of demarcation from the white of the abdomen very trenchant. Smaller than No. 765. Wing 12.00–13.00; tarsus 1.75–1.87; bill 1.35–1.50; tail 5.00–6.00, the long feathers up to 9.00. Nearly mature: Pileum and latero-nuchal region, and whole upper parts, as in the adult. The under parts white (as in the adult), but clouded everywhere with dusky patches, most marked across breast, on sides, flanks, and under tail-coverts, and leaving the middle of the belly and throat nearly pure. Varying degrees of this dusky nubilation approach in some specimens nearly to the uniform dusky below characterized; in others fade almost into the pure white of the adult, connecting the two states perfectly. The tarsi of the most dusky specimens have small yellow blotches; the others not. Dusky stage: Wholly deep dusky; darker and more plumbeous superiorly; lighter, and with a fuliginous tinge, inferiorly; the pileum quite black; the latero-nuchal region yellow; the remiges and rectrices quite black; feet black. Immature: Size and general proportions nearly of the adult. Bill and cere perfectly formed; feet mostly black, but with some yellow blotches. The upper parts unadulterated with any rufous bars; the deep brownish-black pileum has appeared, and the sides of the neck have obtained their yellow shade, which contrasts conspicuously with the fuliginous back-ground. Evidences of immaturity, however, are found on the under parts, where the dark color is mixed with the illy-defined transverse bars of ochraceous. Rufous is also found at the bend of the wing and on the under wing- and tail-coverts. The primaries are still whitish at the outside, as are also the rectrices. The central rectrices project 2½ inches, and have the tapering form of those of the adults. Younger: Small size, delicate bill and feet, little projection of the central rectrices, general mollipilose condition of plumage, etc. The rufous of the very young bird, instead of giving way everywhere to dusky, yields to this color only on the upper parts and crown; on the sides of the head, neck, and the whole under parts, whitish being the predominating color; the continuity of this last being interrupted by indistinctly marked dusky bars. The yellow of the sides of the neck has not yet appeared. There is the same white space on the bases of the wings and tail that exists in the very young. The central tail-feathers only project about 2½ inches. Young-of-the-year in August: Size considerably less than that of the adult, form every way more delicate. Wings more than an inch shorter; bill and feet much slenderer and weaker. Bill in some specimens light bluish-horn; in others greenish-olive, the terminal portion brownish-black. Tarsi and greater part of the toes yellow. The bird is everywhere rayed and barred with rufous and brownish-black. On the head and neck the rufous has a very light ochraceous tinge, and is the predominating color, dark only appearing as a delicate line along the shaft of each feather. Proceeding down the

neck to the back, the longitudinal lines become larger, and gradually spread wider and wider, until between the shoulders they occupy the whole of each feather, except a narrow border of rufous, which latter is of a deeper tint than on the head. Passing down the throat to the breast, the rufous becomes decidedly lighter — almost whitish — while the brown, which on the throat exists only as a light longitudinal line, changes on each feather to transverse bars of about equal width with the light rufous bars with which it alternates. This pattern prevails over the whole under parts, the transverse bands being broadest on the flanks and under tail- and wing-coverts, narrowest in the middle of the belly. The primaries are brownish-black, narrowly tipped with rufous, their shafts yellowish, their inner webs fading basally into white. The tail has the same coloration as the wings. The central feathers project about ¾ of an inch. Northern N. Am.; U. S. in winter; chiefly coastwise, but breeds in interior Arctic Am. Eggs resembling those of *Numenius borealis*, and quite as variable in ground-color and markings; size from 2.00 to 2.40 long, by 1.50 to 1.70 broad, averaging nearer the larger of these dimensions; pointed, but not so pear-shaped as those of the Curlew.

767. S. buffoni. (To the Count de Buffon.) ARCTIC JÄGER. LONG-TAILED JÄGER. Adult, breeding plumage: Bill shorter than the head, less than the middle toe without the claw; stout, compressed, higher than broad at the base, its sides regularly converging. Ceral portion of culmen broad, flat, depressed, slightly concave in outline; ungual portion very decidedly declinato-convex to the greatly overhanging tip; narrower than the ceral. Tomia of superior mandible sinuate; at first concave and ascending; then convex and descending; again very concave as they decurve toward the deflected tip, just posterior to which there is an imperfect notch. Tomia of inferior maxilla nearly straight to the tip, where they are decurved. Gonys very short, slightly concave in outline. Eminentia symphysis acute, but not very large; rami very long as compared with the gonys, but absolutely rather short, from the encroachment of the feathers. Cere very short, being scarcely if at all longer than the unguis; its lower border curving upward to give passage to the nostrils. The encroachment of the feathers on the bill is greater than that of any other species; on the upper mandible they extend within half an inch of the distal end of the cere, having a broad, rounded termination, the feathers of the two sides meeting on and covering the culmen some distance from its real base. The feathers on the sides of the lower mandible extend nearly as far as on the upper, and those between the rami quite to the symphysis. Wings exceedingly long; first primary much the longest; rest rapidly graduated; all rather narrow, tapering, falcate, actually pointed, their rhachides stiff and strong. Secondaries short and inconspicuous; rather broad; their apices as in the other species. Tertials moderately long, very straight, flexible, rounded at their extremities, the edges of their vanes convoluted. Tail very long; longer, both absolutely and relatively, than in any other North American species, being half as long as the wings; graduated, the lateral feather being ¾ of an inch shorter than the next to central pair; all the feathers moderately broad, converging somewhat to their rather broad, rounded tips. Central rectrices extremely lengthened, exceeding the wings; projecting 8 to 10 inches beyond the tips of the lateral ones. They are extremely rigid at the base, being there much stiffer than the other feathers, but gradually become flexible, and at length filamentous in character, but preserve great elasticity throughout. Feet quite slender; tarsus equal to middle toe and claw. Tibiæ bare of feathers for ¾ of an inch. The reticulation of the feet identical with that already described under other species. The scutella of the anterior face of the tarsus, however, show a tendency to degenerate into minute plates near the tibio-tarsal joint. Proportions of the toes as in other species, but the claws are comparatively small and weak, and but moderately curved and acute. Occiput decidedly subcrested. The latero-nuchal region has its feathers lengthened, with disconnected fibrillæ, but they are hardly acuminate or rigid. The plumage about the bill is short, thick, and compact; that of the upper parts is soft and flexible, only moderately imbricated and compact; that of the under parts is long, soft, and very thick. Bill

dusky, its nail almost black. Tarsi deep leaden-blue; tibiæ, phalanges, interdigital membranes, and claws black. Occiput subcrested, more decidedly than in any other species, forming a calotte of brownish-black, which color extends downward on the cheeks, the feathers before and below the eye and on the sides of the bill being of this color. Neck all round, but especially the sides of the head and the peculiarly-formed feathers on the latero-nuchal region, light straw-yellow. Whole upper parts, with upper wing and tail-coverts, deep slate, which, on the primaries, secondaries, lateral tail-feathers, and distal half of central pair, deepens into a lustrous brownish-black. Under surface of wings and tail deeper slate than the black, but not so deep as the upper surfaces. Chin, throat, and upper breast white, gradually becoming obscured with dusky-plumbeous, which deepens posteriorly, so that the abdomen and under tail-coverts are nearly as dark as the back. Rhachides of first two or three primaries pure white, deepening into brownish-black at their tips; of the other primaries, and of the tail-feathers (including the central pair), brown, except just at the base, blackening terminally. Under surfaces of all the rhachides white for nearly their whole length. Length of culmen 1.15 inches; gape 1.70; cere 0.60; unguis about the same; gonys 0.30; from feathers on sides of bill to tip 0.90; wing 12.50; tail 6.25; central pair 14.00 to 16.00; the projection 8.00 to 10.00 inches; tibiæ bare 0.75; tarsus 1.60; middle toe without claw 1.40. All changes and states of plumage identical with those of No. 766. N. Am., northerly; breeds in Arctic regions. Eggs not distinguishable from those of No. 766, averaging smaller but dimensions overlapping; a fair specimen is 2.10 × 1.50; from this down to 1.90 × 1.40.

71. Subfamily LARINÆ: Gulls.

Covering of bill continuous, horny throughout; bill more or less strongly epignathous, compressed, with more or less protuberant gonys; nostrils linear-oblong, median or sub-basal, pervious. Tail even or nearly so, rarely forked or cuneate, without projecting middle feathers. Certain of the smaller slenderer-billed species alone resemble terns, but may be known by the not forked tail (except *Xema*); in all the larger species, the hook of the bill is distinctive. Gulls average much larger than terns, with stouter build; the feet are larger and more ambulatorial, the wings are shorter and not so thin; the birds winnow the air in a steady course unlike the buoyant dashing flight of their relatives. They are cosmopolitan; species occur in abundance on all sea-coasts, and over large inland waters; in general, large numbers are seen together, not only at the breeding-places, but during the migrations, and in winter, when their association depends upon community of interest in the matter of food. This is almost entirely of an animal nature, and consists principally of fish; the birds seem to be always hungry, always feeding or trying to do so. Many kinds procure food by plunging for it, like terns; others pick up floating substances; some of the smaller kinds are adroit parasites of the pelicans, snatching food from their very mouths. They all swim lightly—a circumstance explained by the smallness of the body compared with its apparent dimensions with the feathers on. The voice of the larger species is hoarse, that of the smaller shrill; they have an ordinary note of several abrupt syllables during the breeding season, and a harsh cry of anger or impatience; the young emit a querulous whine. The nest is commonly built on the ground; the eggs, 2–3 in number, are variegated in color.

Several circumstances conspire to render the study of these birds difficult. With some exceptions, they are almost identical in form; while in size they show an unbroken series. Individual variability in size is high; northerly birds are usually appreciably larger than those of the same species hatched further south; the ♂ exceeds the ♀ a little (usually); very old birds are likely to be larger, with especially stouter bill, than young or middle-aged ones. There is, besides, a certain plasticity of organization, or ready susceptibility to modifying influences, so marked that the individuals hatched at a particular spot may be appreciably different in some slight points from others reared but a few miles away. One pattern of color-

ation runs through nearly all the species: they are *white*, with a darker mantle (*stragulum*), and in most cases with black crossing the primaries near the end, the tips of the quills white. The shade of the mantle is very variable in the same species, according to climate, action of the sun, friction, and other causes; the pattern of the black on the quills is still more so, since it is *continually* changing with age, at least until a final stage is reached. Incredible as it may appear, species and even genera have been based upon such shadowy characters. One group of species has the head enveloped in a dark hood in the breeding season, the under parts tinted with peach-blossom hue. The sexes are always alike; the moult appears to be twice a year, so that a winter plumage more or less different from that of summer results; while the young are never like the old. The change is slow, generally requiring 2–3 years; in the interim, birds are found in every stage. They are always *darker* than the old, often quite dusky; usually with black or flesh-colored bill; and if with black on the primaries when adult, the young usually have these quills all black. There being no peculiar extra-limital species, those of our country give a perfect idea of the whole group. Some 75 species are current; there are certainly not over 50 good ones.

Analysis of Genera.

Tail square.
- Head never hooded; under parts never rosy-tinted; size medium and large; bill stout.
  - Hallux well developed, with perfect claw.
    - Adult white, with a colored mantle, or dark, with white head . . . . . *Larus* 308
    - Adult entirely white; feet black . . . . . *Pagophila* 310
  - Hallux usually defective. (Tail emarginate in the young) . . . . . *Rissa* 309
- Head in summer hooded, and under parts rosy-tinted; size medium and small; bill slender . . . . . *Chroicocephalus* 311

Tail wedge-shaped; neck collared; small . . . . . *Rhodostethia* 312

Tail forked; head hooded . . . . . *Xema* 313

308. **LA'RUS.** (Gr. λάρος, *laros*, Lat. *larus*, a gull.) GULLS. Bill shorter than the head or tarsus, large, strong, more or less robust, usually very stout, deep at the base, higher than broad, compressed throughout, the apex not very acute and never much attenuated or decurved. Culmen about straight to beyond the nostrils, then convex, the amount of curvature increasing toward the end, varying in different species. Commissure slightly sinuate at its extreme base, then about straight to near the end, where it is more or less arcuato-declinate. Eminentia symphysis always large, prominent, and well-defined, rather obtuse, seldom acute. Nostrils placed rather far forward in a well-defined nasal fossa, lateral, longitudinal, pervious, rather broader anteriorly than posteriorly. Feathers of forehead extending considerably farther on the sides of the upper mandible than on its culmen, but falling considerably short of the nostrils. Wings when folded reaching beyond the tail, the remiges strong, not very acute, first longest, second but little shorter, rest rapidly graduated. Tail of moderate length, always even, never forked nor rounded. Legs rather slender, of moderate length; tibiæ bare for a considerable distance above the joint, the naked part smooth. Tarsi about equal to or a little longer than the middle toe and claw, varying but slightly in proportions among the different species; anteriorly scutellate, posteriorly and laterally reticulate. Hallux fully developed and always present. Anterior claws stout, strong, little curved, rather obtuse, the inner edge of the middle one dilated. Webs full and broad, scarcely incised. Of very large or medium size, never very small. Robust and powerful. Comprising the largest species of the subfamily and those typical of it. White, with a darker mantle, without a hood; the head and neck in winter streaked with dusky; one species dark with white head and red bill.

Analysis of Species.

I. Tail and under parts white in adult; bill and feet not reddish. (*Larus.*)
- *A.* Large and robust: mantle whitish or pale pearly; no black on primaries at any age.
  - Mantle very pale; primaries the same, fading insensibly into white far from the tips.
    - Larger: length about 30.00 inches; wing 18.00 or more; bill and tarsus, each, about 3.00 . . . . . *glaucus* 768

Smaller: length about 24.00 inches; wing 17.00 or less; bill about 2.00; tarsus 2.25 *leucopterus* 769
Mantle light blue; primaries the same, with definite white tips . . . . . *glaucescens* 770
Mantle very pale blue, as in *leucopterus;* primaries with slate-gray markings . . . . *kumlieni* 770*a*
B. Very large: mantle slaty-blackish; primaries crossed with black; size of the first . . *marinus* 771
C. Large: mantle some shade of blue, darker than in *A*, lighter than in *B;* primaries crossed with black.
Mantle grayish-blue; bill moderately robust; feet flesh-colored *argentatus* or *smithsonianus* 772, 773
Mantle slaty-blue; bill very robust; feet flesh-colored . . . . . *occidentalis* 774
Mantle dark grayish-blue; bill moderately robust; feet yellow; eye-ring orange . *cachinnans* 775
Mantle dark slate; bill moderately robust; feet flesh-colored . . . . . *affinis* 776
D. Medium and small: primaries crossed with black; feet dark-greenish; webs yellow.
Tarsus obviously longer than the middle toe and claw; bill of adult greenish-yellow, encircled with a black band; first primary usually with a sub-apical white spot; length about 18.00–22.00 *delawarensis* 778
Tarsus little if any longer than middle toe and claw; bill with a red spot, but an imperfect black band, if any; first primary usually with the end broadly white; length about 20.00–22.00 *californicus* 777
Tarsus little if any longer than the middle toe and claw; bill slender, greenish, without a black band or red spot; size very small; length 16.00 or 18.00 . . . . *canus* or *brachyrhynchus* 779, 780
II. Tail and under parts dark in adult. Head white; bill and feet reddish. (*Blasipus.*)
Back slaty-lead color . . . . . *heermanni* 781

768. L. glau'cus. (Gr. γλαυκός, *glaukos*, Lat. *glaucus*, bluish.) GLAUCOUS GULL. ICE GULL. BURGOMASTER. Very large: length about 30.00; extent 60.00; wing up to 18.50; bill 2.75–3.00 (chord of culmen), along gape 3.75, its depth opposite nostrils 0.80, at angle 0.85; tarsus 3.00–3.25; middle toe and claw 2.75. No black anywhere at any age. Adult ♂ ♀: Bill large and strong, very wide, but not so deep at angle nor so convex at end as in *marinus*, about as long as middle toe and claw; chrome yellow, the tip diaphanous yellow, a vermilion spot at the angle. Legs and feet pale flesh-color or yellowish. Iris yellow. Primaries entirely white, or palest possible pearly-blue, fading insensibly into white at some distance from their tips, their shafts straw-yellow. Mantle very pale pearl-blue. Otherwise, wholly white. In winter: Head and hind neck lightly touched with pale brownish-gray. An immature stage: Entirely white; bill flesh-colored, black-tipped. Young: Bill flesh-colored, black-tipped; plumage impure white, mottled with pale reddish-brown, sometimes quite dusky on the back; under parts a nearly uniform pale shade of brownish; quills and tail imperfectly barred with the same. Smaller: wing 17.50; bill 2.40; tarsus 2.40, etc. Northern and Arctic seas, circumpolar; S. in winter in N. Am. to the Middle States, coastwise; breeds only in the high north. This is one of the very largest and most powerful birds of the whole family, fully equalling *L. marinus* in these respects.

769. L. leucop'terus. (Gr. λευκός, *leucos*, white; πτερόν, *pteron*, wing.) WHITE-WINGED GULL. Precisely like the last, but smaller. Length 24.00, rather less than more; wing 16.00–17.00; bill along culmen 1.75–2.00, along gape about 2.75; depth at angle 0.65; tarsus 2.00–2.25, not longer than middle toe and claw. This counterpart of *L. glaucus* inhabits the same northerly regions, coming south to the same degree in winter. It appears to be much less characteristic of N. Am. than of Europe.

770. L. glaucescens. (Lat. *glaucescens*, growing bluish.) GLAUCOUS-WINGED GULL. Like a herring gull with the black of the primaries washed out; primaries of the color of the mantle to the very tips, which are occupied by definite small white spots; the 1st also with a large white sub-terminal spot. Bill long and rather weak, the upper mandible acute and projecting considerably beyond tip of the under, the convexity near the end comparatively slight; angle pretty well defined, the outline between it and the tip about straight. Tarsus rather longer than middle toe and claw. Length about 27.00; wing 16.75; bill along culmen 2.25; gape 3.25; depth at angle 0.70; tarsus 2.60; middle toe and claw 2.50. Adult in summer: Bill light yellow, an orange spot at angle of lower mandible, and a dusky one just above. Mandible pearl-blue, much the same shade as in *argentatus*. Primaries scarcely darker than the back, all with well-defined, rounded apical spots of white. First, the base not appreciably

lighter than the body of the feather, with a well-defined white spot on both webs near the end, separated from the white tip by a transverse band of the color of the body of the feather; second, third, and fourth, basal portions notably lighter than the terminal, fading into pure white at their juncture with the latter, without spots except at the apex; fifth, sixth, basal portions the color of the back, fading into white near the end, separated from the white apices by a band, narrowest on the sixth, of the color of the outer primaries. Inner primaries like the secondaries, with plain broadly white ends. Feet light flesh-color. Adult in winter: Head, neck, and breast thickly nebulated with light grayish-dusky, the throat mostly immaculate. Approaching maturity: Bill dark-colored, yellowish along the culmen and gonys. Wings and tail light grayish-ashy, the former without sharply-defined white tips or spots. Under parts generally marked with dusky, the wing-coverts marked with dusky and white. Feathers of the back narrowly edged with gray. Intermediate: Bill flesh-colored, the terminal portion black. Wings and tail darker than in the preceding especially on the outer webs of the former. Everywhere dusky-gray, more or less mottled with white, the gull-blue of the upper parts appearing in patches of greater or less extent. Young-of-the-year: Bill black. Everywhere grayish-dusky, somewhat mottled with whitish; the feathers of the back, wings, and upper tail-coverts edged, tipped, and crossed with more or less regular transverse bars of grayish-white. Downy young: Bill and feet black; head and neck dull whitish, spotted with blackish; upper parts spotted with grayish-black and grayish-white; under parts more uniformly gray, the abdomen white. Pacific coast of N. Am., of U. S. in winter, breeding northerly; common. Also on the Asiatic coast.

770a. L. kumlieni. (To L. Kumlien.) GRAY-WINGED GULL. Adult ♂: Like *glaucescens;* rather smaller, with lighter mantle and different color and pattern of the primaries. Mantle about as in *leucopterus;* primaries and secondaries mostly white on their exposed surfaces, with markings of dull slate-gray. First primary white on both webs at end for about two inches, the inner web white to the base excepting a slate-gray strip next the shaft, the outer web (except at end) slate-gray fading into white toward the base. Second primary with the gray confined to a space of about four inches on the outer web, and both webs tinged with the color of the mantle which, on the inner web, fades into white about three inches from the tip, but on the outer web is deepest where it joins the darker gray area. Third primary with subapical gray bar on both webs, half an inch wide on inner web, but running along the outer web for two inches; the tip of this feather white, the rest tinged with the color of the mantle. Fourth primary with a slate-gray subterminal bar, but narrower and paler; fifth with a pair of subterminal gray spots; remaining primaries and all the secondaries plain and concolor with mantle to within about two inches of their tips, where the pearl-blue changes rather abruptly into white. Iris cream-color; bill yellow with red spot, as usual; orbital ring reddish; feet flesh-color. Length 24.00; extent 50.00; wing 16.00–17.00; tail 6.50; chord of culmen 1.75; gape 2.60; tarsus, or middle toe and claw, about 2.30. Young said to be even darker than that of *argentatus* (?) Cumberland Sound and Greenland, S. in winter to New England, the citations of "*glaucescens*" from Maine belonging here. (Description compiled from Brewster, Bull. Nutt. Club, viii, 1883, p. 216. The bird is probably *L. chalcopterus* of Bruch, Lawrence, and Coues.)

771. L. mari'nus. (Lat. *marinus*, marine). GREAT BLACK-BACKED GULL. SADDLE-BACK. COFFIN-CARRIER. COBB. Adult, breeding plumage: Size very large; general form strong, compact, and powerful. Bill very stout, deep at the angle, rather short for its height; culmen toward the end exceedingly convex, so much so as to make a tangent to it at the point where the tip of the lower mandible touches it perpendicular to the commissure. Symphyseal eminence very prominent; tarsus but little if any longer than the middle toe and claw, compressed, rather slender for the size of the bird. Bill bright chrome, the tip of both mandibles diaphanous. A large bright vermilion spot occupies nearly the terminal half of the lower mandible

and encroaches a little on the upper. Edges of jaws bright vermilion. Palate and tongue pale orange-red. Eyelids vermilion. Iris pale lemon-yellow. Legs and feet pale flesh-color. Mantle intense slate-color, nearly black, with a purplish reflection; secondaries and tertials broadly tipped with white, the line of demarcation distinct. Primaries: first, black, scarcely lighter at its base, its tip white for 2½ inches, its shaft white inferiorly, and superiorly along the white portion of the feather; second, like the first, but its base lighter, the white tip less extensive, and interrupted by a narrow bar of black on one or both webs; third, fourth, fifth, broadly tipped with white, their bases of a lighter shade of slate than the second, and fading into white at the junction with the broad black subterminal band. Adult in winter: As in summer, but the head and neck streaked with dusky. Young-of-the-year: As large as the adult; the bill as large, but not so strong, nor the eminence so well developed; wholly black. Upper parts wholly dusky chocolate-brown, mottled with whitish and light rufous, the latter on the back and wings, the feathers being tipped and the wing-coverts deeply indented with this color. Under parts mottled with white or rufous-white and dusky, the throat mostly immaculate. Primaries and tail deep brownish-black, the former tipped, subterminally barred, and its outer feather mottled, with whitish. Dimensions: length 30.00 inches; extent 65.00; wing 19.00; bill above 2.50; rictus 3.50; height at nostril 0.85; at angle 0.95; tarsus 3.00; middle toe and claw slightly less. This great bird, the dark rival of the ice-gull, inhabits the Atlantic coasts of Europe and N. Am., ranging south coastwise in winter to Florida, breeding beyond the U. S., especially in Labrador. Found on the larger inland waters as well as coastwise. Nest on the ground, of moss and seaweed; eggs 3, 2.90 × 2.15, pale drab or olive-gray, irregularly blotched with dark brown and blackish, with purplish or neutral-tint shell-spots.

772. L. argenta'tus. (Lat. *argentatus*, silvered, silvery.) EUROPEAN HERRING GULL. Precisely like the next to be described, excepting the following particulars: Average smaller size; wing averaging 1.50 inches shorter; feet about 0.50 shorter on an average; bill shorter and slenderer, particularly at base. The 1st primary has usually a white terminal space 2 inches long; the 2d a large rounded sub-terminal white spot, occupying both webs. The 1st primary of the American bird has usually a rounded white subterminal spot much like that on the 2d primary of the European, almost always separated from the white apical spot, and if a spot is present on the 2d primary it is small. A variety is predicable upon these average differences. Birds typically like the European occur in N. Am., where the next is the ordinary "herring gull."

773. L. a. smithsonia'nus. (To the S. I.) AMERICAN HERRING GULL. Adult: Bill rather less than tarsus, shorter than head; robust, its height at the angle slightly more than at the base. Culmen nearly straight at the nostrils; then rapidly convex to the stout, deflected, overhanging apex. Outline of rami slightly concave; gonys about straight; eminence at symphysis large and prominent, but its apex not very acute. Breeding plumage: Bill bright chrome, its tip diaphanous, a vermilion spot at the angle, with sometimes a small black one just anterior to it. Legs and feet *pale flesh-color;* claws blackish. Mantle typical "gull-blue," much lighter than in *occidentalis;* lighter than in *brachyrhynchus;* of much the same shade as in *delawarensis* or *glaucescens;* darker than in *glaucus* or *leucopterus*. The bases of the primaries are the same as the back, or very slightly lighter, not so light, nor of so great extent (being exceedingly short on the first primary), nor so broad at the end, as in *californicus*. On the first primary this light basal portion is very short, hardly reaching within six or seven inches of the tip of the primary. It is not lighter at its junction with the black, nor does it extend further on the central portion than on the edge of the feather. On the second, third, and fourth primaries the bluish of the basal portions of the feather extends about the same distance on each (within four inches of the tip of the second), and runs up further on the centres of the feathers than on their edges, and grows nearly white at its junction with the black portion of the feathers. First primary with a subapical white spot near its tip; small, rounded, not much over an inch in diameter; generally not longer on the outer vane than on the inner; sometimes wanting on

the former; in oldest birds this spot enlarging to coalesce with the white tip of the feather; second primary usually without a subapical spot, or if one is present it is small. All the primaries with small rounded white apices, and black from these apical spots to their bluish-white bases; this band of black growing narrower from the first toward the seventh, where it is a mere point. Winter plumage: Head and neck streaked with dusky; bill less brightly colored. Otherwise as in summer. Immature: The feathers of the back have gray margins; the upper wing-coverts mottled with dusky-gray. An imperfect subterminal bar of dusky on the tail. Young of first winter: Head, neck, and whole under parts more or less thickly mottled with dusky, as are the wing-coverts, secondaries, and tertials. The gull-blue of the upper parts appears in irregular patches, mixed with gray. Remiges and rectrices brownish-black, with very narrow whitish tips, the former wanting both apical and subapical white spots. Bill flesh-color, its terminal third black. Feet dull flesh-color. Younger: Entirely a deep dull brownish; the throat lightly streaked and the rump transversely barred with whitish; the feathers of the back with yellowish or grayish-white edges; wings and tail black; bill black; legs and feet dusky flesh-color. Dimensions of adult: length, 24 to 25 inches; extent 54 to 58; wing 17.00 to 18.00; bill along culmen, 2.40; height at nostril, 0.75; at angle 0.80; tarsus 2.75; middle toe and claw the same. Female a little, and young considerably less than the above. Wing down to 15.50; bill to 2.20; tarsus to 2.40. N. Am. at large, abundant, both coastwise and in the interior, especially numerous along the Atlantic coast in winter; casually on the Pacific coast. Breeds from New England and the great lakes northward, especially about the St. Lawrence, Newfoundland, and Labrador; but not specially arctic. Nest on the ground, exceptionally in trees; eggs normally 3, averaging 2.80 × 1.95; ground-color from light bluish- or greenish-white to dark brownish-olive; markings of every size and shape, very irregularly disposed, dark brown and blackish, paler brown and neutral-tint; June and early July. Nestlings covered with whitish down, mottled with angular dusky spots.

774. L. occidenta'lis. (Lat. *occidentalis*, western.) Western Herring Gull. Bill large, very stout and deep; culmen unusually convex at the end; angle strongly developed, making the under outline doubly-concave. Feet large and stout; tarsus equal to middle toe and claw. Adult, summer plumage: Bill bright chrome-yellow; a vermilion spot, more or less extensive, at the angle. Mantle dark bluish-ash, almost slate-color; the tips of the secondaries and tertials white; the line of demarcation distinct. Primaries: first three black throughout their exposed portions, the outer white for some distance at the tip (1.75 inches), crossed near the end with an irregular black bar, the shafts entirely black; second, without a white spot, but its tip, and the tips of all the others, white. Legs and feet flesh-color. Approaching maturity: As in the preceding, but the upper parts rather lighter, and the tail with an imperfect subterminal bar of black. Intermediate: Bill much as in the adult. White of the head, neck, and under parts, more or less mottled with dusky; "gull-blue" of the upper parts appearing in irregular patches; most of the feathers tipped with light gray. Primaries and tail uniform deep blackish-brown, with scarcely lighter tips, the former without spots. Young-of-the-year: Bill entirely black, rather shorter than in the adults, but at the same time with great comparative depth at the angle. Everywhere a deep blackish-brown, mottled with grayish-white, the feathers of the upper parts being tipped and edged with that color. Rump and upper tail-coverts barred with whitish and dusky. Wings and tail as in the preceding. Winter plumage: This species seems to form an exception to the rule which obtains so extensively among large gulls, since in winter the head and neck behind are not, ordinarily at least, streaked with dusky. Dimensions of adult: length 24 inches; extent 55.00; wing 16.50; bill above 2.30; along gape 3.10; height at nostril 0.75; width 0.40; height at angle 0.85; tarsus, and middle toe and claw, 2.75. Pacific Coast of N. A., very common.

775. L. cachin'nans. (Lat. *cachinnans*, laughing immoderately.) Pallas's Gull. Size, proportions of parts, pattern of primaries, etc., as in a common Herring Gull. Feet yellow (not

flesh-color); ring round eye in the breeding season orange-red (not yellow). Mantle *dark* bluish — *much* darker than that of *argentatus*, yet not slate-colored as in *occidentalis*. Europe, Asia, and N. W. coast of N. A.

776. **L. affi'nis.** (Lat. *affinis*, allied to *L. fuscus*.) REINHARDT'S GULL. Unknown to me; Described as a slaty-backed bird, resembling *L. fuscus*, but belonging to the herring gull group in the pattern of the primaries; feet flesh-colored, small, toes shorter than tarsi. Asia; only N. American as occurring in Alaska and accidentally in Greenland.

777. **L. califor'nicus.** CALIFORNIAN GULL. Adult, summer plumage: Bill moderately stout, the angle well developed; varying in size, longer than in *delawarensis*, sometimes nearly equalling *argentatus*. Tarsus equal to or slightly longer than middle toe and claw. Bill chrome-yellow, tinged with greenish; a vermilion spot on lower mandible at angle; a black spot just above, forming, with a very small black spot on the upper mandible, an imperfect transverse band. Feet dusky *bluish-green*, the webs *yellow*. Mantle pearl-blue, much as in *brachyrhynchus*, lighter than in *canus*, slightly darker than in *argentatus*. Primaries: bases of all light bluish-white, internally almost white, especially on outer webs, and of great extent on all; 1st with a white space at the end for about 2 inches, the shaft white along the white portion of the feather; 2d with a white spot near the end on the whole of the inner and most of the outer web, divided by the black shaft; tips of all white; black forming merely a narrow subterminal band on the 6th. Tips of inner primaries white, as are also the tips of the secondaries and tertials, the line of demarcation between the white and the blue of the mantle pretty distinct. In breeding plumage: Eyelids bright saffron-yellow or red. Eyes brown. Upper mandible bright chrome, the greater part of the lower vermilion, the rest chrome. Gape of mouth deep crimson. Feet green. Winter plumage: Bill dully colored. Head and neck behind streaked and mottled with dusky. Nearly mature: As in the preceding. Tail with an imperfect subterminal black bar. Some of the feathers of the upper parts edged with gray. White space at end of 1st primary crossed by a transverse black bar; no spot on 2d primary. Young: Bill yellowish flesh-color, black on the terminal half. Head, neck, rump, wing-coverts, tertials and secondaries, mottled with dusky. Primaries and tail uniformly brownish-black, scarcely lighter at the tips. Back as in the adults, but the feathers with grayish edges. Dimensions: Length 20.00–23.00; extent 50.00–54.00; wing 15.00–17.00; bill 1.60–2.00; depth at eminentia symphysis 0.56; tarsus 2.00–2.25; middle toe and claw about the same. Adults near the larger of these dimensions. Western and Arctic N. Am., breeding abundantly in U. S.

778. **L. delawaren'sis.** (Of Delaware.) RING-BILLED GULL. COMMON AMERICAN GULL. Adult in summer: Bill rather stout, as long as the middle toe and claw; the upper mandible considerably convex at the end; under mandible much thickened at the angle, which is prominent; the outline from base to angle, and from angle to tip, both concave. Middle toe and claw scarcely more than ¾ the tarsus. Bill greenish-yellow, at tip chrome, encircled at the angle with a broad band of black. Legs and feet dusky bluish-green. Mantle light pearl-blue, fading into white at the ends of the secondaries and tertials, the line of demarcation indistinct. Primaries: 1st black, the basal portion of the inner web very light bluish-white, (almost white), with a spot of white about 1.25 inches long near the end, of equal extent on both webs, divided by the black shaft; 2d with a small white spot on the inner web, and the inner web whitish at base for a longer distance; the whitish of the bases of the primaries regularly increases inward and the black decreases, until on the 6th it is merely a transverse bar. Apex of 1st primary black, of others white, the spot being very minute on the 2d, and gradually increasing; 7th and innermost primaries without any black, like the secondaries. Adult in winter: As in summer, but the head and neck behind spotted (not streaked nor nebulated) with dusky. Young, first winter: Upper parts irregularly mottled with dusky brown and the pearl-blue of the adults, the wing-coverts being almost entirely dusky, with lighter margins

to the feathers. Head, neck, and under parts, mottled with white and dusky. Primaries uniformly black; secondaries with a patch of brownish-black near the ends; tertials wholly brownish-black, narrowly tipped with whitish. Tail with a broad subterminal band of black, narrowly tipped with white. Terminal half of bill black, the extreme tip yellowish. Young-of-the-year in August: Everywhere mottled thickly with brownish-black, on the upper parts the feathers with yellowish-white edges, the pearl-blue of the adults scarcely apparent, except on the wing-coverts. Terminal two-thirds of bill with the tip black, the rest light flesh-color. Dimensions: length 19.75; extent 48.50; wing 14.75; bill above 1.70; gape 2.30; height at nostril 0.45; at angle 0.50; tarsus 2.10; middle toe 1.80. N. Am. at large, on the whole the commonest species, both coastwise and in the interior; breeds in the U. S. as well as far north.

779. **L. ca/nus.** (Lat. *canus*, hoary gray.) EUROPEAN MEW GULL. Assigned to N. A. on strength of a specimen shot by me in Labrador in 1860. It is entirely like the next to be described excepting the following particulars: Tarsus a fourth longer than the middle toe and claw. Bill stouter, with less convex culmen and better developed angle. The bluish bases of the primaries darker, not fading into white at their junction with the black, not running so far along the feathers, nor farther in the centres than along the edges of the inner webs. Size greater. Probably not more than varietally distinct from the next to be described.

780. **L. brachyrhyn/chus.** (Gr. *βραχύς*, *brachus*, short; *ῥύγχος*, *hrugchos*, beak.) AMERICAN MEW GULL. Bill small, somewhat stout for its length, much shorter than the head or tarsus. Upper mandible straight to the end of the nostrils, moderately convex to the tip, rather more so than in *canus*. Angle of lower mandible pretty well-developed, comparatively more so than in *canus*; the lower outline considerably concave posterior to it, somewhat so before it. Commissure about straight to near the tip. Tarsus and middle toe and claw about equal, the former but little if any longer than the latter. Adult in summer: Bill bluish-green, its terminal third bright yellow. Legs and feet dusky bluish-green, the webs yellowish. Mantle light grayish-blue or dark pearl-blue, a shade darker than in *canus*, much darker than in *delawarensis*. Primaries: the bluish-gray bases rather lighter than in *canus*, much darker than in *delawarensis*, but fading into nearly pure white on all but the first at the juncture with the black portion; these bluish-gray bases of the feathers extend toward the ends much further than in *canus*, as far as in *delawarensis*, and, as in that species, on the 2d, 3d, and 4th, extend further along the central portions of the inner web than at the edges, so that they are bordered for some distance with the black of the terminal portions of the feathers. The black takes in the outer web of the 1st primary and nearly the whole of the inner, but rapidly becomes narrower, till it is merely a subterminal transverse bar on the 6th. The 7th has frequently a spot of black on one or both webs. First, with a large white spot near the end two inches long, longer on the outer than on the inner web, not divided by the black shaft, the tip of the feather black; 2d, with a similar spot, but smaller, not longer on the outer than on the inner web, and divided by the black shaft; the extreme apex white, as are the apices of all the other primaries except the 1st. Adult, high breeding plumage: Eyelid, ocular region, and gape of mouth, bright orange-yellow, which color extends over the tip and cutting edges of the bill. The green of the bill with a peculiar hoary glaucescence. Legs and feet bluish-green, the webs bright gamboge-yellow. Sometimes a faint pink blush of the plumage of the under parts. Adult in winter: The head and neck all round, with the upper part of the breast, mottled with dusky. Approaching maturity: Head and neck faintly mottled. Primaries brownish-black, without decided white tips; the spots on the 1st and 2d restricted. Tertials with a dusky spot on each web near the end. Tail with a more or less perfect subterminal band. Young, first winter: Bill flesh-color; black on the terminal half. Legs and feet light yellowish. Head, neck, rump, and whole under parts, mottled irregularly with dusky. Back as in the adult, but the feathers with grayish edgings. Wing-coverts, secondaries, and tertials

dusky; darkest on the latter; all with light edgings. Primaries uniform brownish-black, without white spots, tips, or lighter bases. Tail almost entirely brownish-black, with a narrow border of white. Young in August: Bill and legs as in the preceding. Everywhere whitish-gray; the white of the under parts appearing as mottling, and the blue of the upper parts as irregular patches. Dimensions: length 17.50; extent 42.00; wing 13.75; bill above 1.40; gape 2.00; width at nostrils 0.25; height 0.35, height at angle 0.35; tarsus, and middle toe with claw, 1.80. Interior of Arctic America, and Pacific coast generally. Not authenticated as occurring on the Atlantic coast. The American representative of *L. canus*.

781. **L. heermanni.** (To Dr. A. L. Heermann. Fig. 509.) WHITE-HEADED GULL. Very different from any of the foregoing, belonging to a different section of the genus (*Blasipus*). Bill shorter than head or tarsus, rather slender, moderately compressed, the tip rather acute; its color red in part in the adult. Folded wings reaching beyond the tail. Tail of moderate length, even, slightly emarginate in the young. Feet rather large. Tarsus equal to the middle toe and claw. General colors dark; tail mostly blackish. Adult, breeding plumage: Bill bright vermilion red, black for its terminal third, sometimes wholly red; a red ring around eye. Head white; this color gradually merging on the neck into plumbeous-ash, which extends over the whole under parts, being lighter on the abdomen and under tail-coverts than elsewhere. The back is deep plumbeous-slate, lighter on the rump. Upper tail-coverts clear ashy. Upper surfaces of wings like the back; the primaries black; the tips of all, except the two or three outer ones, narrowly white. Tail black, narrowly tipped with white. Legs and feet reddish-black. Young-of-the-year: Smaller than the adult. Bill and feet brownish-black. Entire plumage deep sooty or fuliginous-blackish; all the feathers, but especially those of the back and upper wing-coverts, edged with grayish-white. Primaries and secondaries black, as in the adults, with only traces of white tips on the former. Tail black, very narrowly tipped with dull white. Immature: Bill as in the adult. Head all round, and the throat, mottled with brownish-black and dull white, the latter color predominating on the forehead and throat. Upper tail-coverts lighter than in the adult, and the white tips of the tail-feathers broader; otherwise generally as in the adult, but with all the colors rather deeper. Dimensions: "length about 17.50; wing 13.50; tail 5.50"; length of skin 18.50; wing 14.00; tail 5.75; bill along culmen 1.80; along gape 2.40; depth at base 0.55; at angle, about the same; tarsus 2.20; middle toe and claw a little less. Young: wing 12.25; tail 4.75; bill along culmen 1.00; depth at base 0.50; at angle 0.45; tarsus 1.90. Length of some skins up to about 20 inches. Pacific coast of N. Am., from British Columbia to Guatemala; singular among all our species in dark lead-color with white head and red bill; common on the California coast.

FIG. 509. — White-headed Gull, ⅔ nat. size. (From Sclater and Salvin.)

309. **RIS'SA.** (Icelandic name, *rissa* or *ritsa*.) KITTIWAKES. Bill stout, rather short, little compressed at the base, shorter than the head, equal to middle toe without claw, longer than tarsus; tip decurved and attenuated; convexity of culmen regular and gradual from base to tip; gonys concave, in consequence of the great deflection of the apex of lower mandible; outline of rami slightly concave; eminentia symphysis well marked and acute, but not large. Wings very long, pointed, reaching beyond the tail; the primaries pointed, first longest. Tail moderately long, even or (in young) emarginate. Legs stout and short. Tarsus remarkably short, less than middle toe alone; anterior toes all long, and united by broad, full webs with unincised mar-

gius. Hallux rudimentary or not well developed, the ungual phalanx being generally obsolete Pattern of primaries and livery of the young, peculiar. Nests on crags.

Analysis of Species.

Feet dark; bill clouded with olivaceous, about 1.50 long; wing 12.00.
Hallux rudimentary, without a claw-bearing phalanx . . . . . *tridactyla* 782
Hallux better formed, bearing a claw . . . . . *kotzebuii* 783
Feet coral red (drying yellow); bill clear yellow, about 1.20; wing 13.00 . . . . . *brevirostris* 784

782. R. tridac'tyla. (Lat. *tris*, thrice; *dactylus*, digit.) COMMON KITTIWAKE. Hind toe only appearing as a minute knob, its claw abortive. Adult, breeding plumage: Bill light yellow, clouded with olivaceous. Head and neck all round, under parts and tail, pure white. Mantle rather dark bluish or cinereous-blue, the tertiaries and secondaries of the same color nearly to their tips, which are white. Primaries: the first very light bluish-white, without white apex, its outer web, and its inner web for about two inches from the tip, black; second like the first, but without the black outer web, its tip being black for nearly the same distance as the first, its apex with a minute white spot; on the third and fourth the black tips grow shorter, while the apices are more broadly white; this lessening of the black on each feather is exactly proportional to the shortening of the successive quills, bringing the bases of all the black tips in the same straight line (a pattern peculiar to the species of *Rissa*). A sub-apical black spot is usually present on one or both webs, but is sometimes absent. Legs and feet blackish. Iris reddish-brown; eye-ring red. Adult in winter: Occiput, nape behind, and sides of the breast, clouded with the color of the back, deepening into slate over the auriculars. A very small but well-defined black crescent before the eye. Otherwise as in summer. Young: Bill black; an ante-ocular crescent, and a post-ocular spot, dusky-slate. A broad transverse bar across the neck behind, the whole of the lesser and median wing-coverts, the bastard quills, the tertiaries, except at their edges, and a terminal bar on the tail, black. The outer four primaries with their outer webs, outer half of inner webs, and tips for some distance, black, the rest of the feathers pearly white. Tips only of the fifth and sixth black, their extreme apices with a white speck. Length 16.00–18.00; extent 36.00; wing 12.25; bill above 1.40 to 1.50; along rictus 2.10; height at base 0.50; at angle 0.40; tarsus 1.30; middle toe and claw 1.80. Arctic America and Europe, chiefly coastwise, very abundant; breeds from New England northward; ranges in winter S. to the Middle States. Nests preferably not on the ground like most gulls, but on the ledges of rocks and cliffs overhanging the water, such as the guillemots select; nest of sea-weeds, etc. Eggs like those of other gulls, 2.25 × 1.80.

783. R. t. kotzebui'i. (To Otto von Kotzebue, the Russian navigator.) KOTZEBUE'S KITTIWAKE. It is a curious fact that the common kittiwake of the North Pacific usually has the hind toe better formed — sometimes nearly if not quite as long as in ordinary gulls, with a nearly or quite perfect, though small, claw. But I cannot predicate a specific character on this score, since the development of the toe is by insensible degrees. (See COUES, Proc. Phila. Acad., 1869, p. 207 (footnote); Birds N. W., 1874, p. 644.) N. Pacific coast, abundant.

784. R. breviros'tris. (Lat. *brevirostris*, short-billed.) SHORT-BILLED KITTIWAKE. RED-LEGGED KITTIWAKE. Adult, breeding plumage: Bill very short, stout, wide at the base, the upper mandible much curved, though not attenuated nor very acute. Convexity of culmen very great toward the tip; the culmen being, from the nostrils to the apex, almost the arc of a circle, whose centre is the symphyseal eminence. Outline of rami of under mandible and gonys both somewhat concave; the eminentia symphysis but slightly developed. Tarsus very short, hardly more than two-thirds the middle toe and claw. Wings exceedingly long, reaching, when folded, far beyond the tail. Tail of moderate length, even. Bill a uniform clear light straw-yellow, with little or no tinge of olivaceous; iris hazel; eye-ring red. Head and neck all round, under parts and tail, pure white. Mantle deep leaden or bluish-gray, much darker than in *R. tridactyla*; the color on the wings extending to within half an inch of the apices of

the secondaries, which terminal half-inch is white. Primaries: the first has its shaft and outer vane black, but has on its inner vane a space of dull gray (not white), which at the base of the feather occupies nearly all the vane, but gradually grows narrower until it ends by a well-defined rounded termination half as broad as the vane itself, about 2½ inches from the tip of the feather, these 2½ inches being black, like the outer vane. Second: the outer vane is of the same leaden gray as the back, to within four inches of the tip; the inner vane is of a rather lighter shade of the same color, to within three inches of the tip, the gray ending abruptly, being in fact almost truncated. Third: like the second, but the gray extends further, leaving only a space of two inches black; and the tip has also a minute apical gray spot. Fourth: wholly bluish-gray to within 1½ inches of the tip, which has a larger gray apical spot than has the third, so that the black is less than 1½ inches long. Fifth: the gray extends so far that it is separated from the well-defined white apical spot by a band of black less than 1½ inch wide. Sixth: gray, fading into white at the tip, and with the black reduced to a small subapical spot on one or both webs; other primaries like the sixth, minus the black spot. (This "gray" of the primaries is the color of the mantle.) Legs and feet coral-red, especially the toes and webs (the tarsi not quite so bright); drying yellow. Claws black. Young not seen. Bird at times said to have a black eye-ring and dark spot behind eye. Nestlings covered with white down, with whitish bill and feet. Dimensions: Bill along culmen 1.20 inches; along rictus about 1.70; from nostril to tip 0.60; depth at base 0.50; width 0.42; depth at symphyseal eminence 0.42; wing 13.00; tail about 5.00; tarsus 1.25; middle toe and claw nearly 2.00; length of the whole bird, apparently about 14 inches. A beautiful and very distinct species, swarming by thousands in islands in Bering's sea, where it is a permanent resident; nests on shelves of the most inaccessible crags, building a substantial structure of grass, moss, and seaweeds, mixed with mud; eggs 2–3, size and shape of a hen's eggs, of the usual pattern of coloration: June, July.

310. **PAGO'PHILA.** (Gr. *πάγος, pagos*, ice; *φίλος, philos*, loving.) Ice Gulls. Bill very short, much less than the head, only about equal to the short tarsus, very stout, little compressed, the nasal fossa deep, the nostrils placed far forward. Legs and feet very short and stout, the scales of the tarsus and toes large and rough. Tibia feathered to near the joint; tarsus short, about as long as middle toe without claw; claws large, strong, and much curved; webs narrow and much incised; a slight connection of hind with inner toe. Size moderate; form stout; color entirely white. One species.

785. **P. ebur'nea.** (Lat. *eburnea*, of or like *ebur*, ivory.) Ivory Gull. Adult, breeding plumage: Culmen straight to the nostrils, then regularly convex; commissure gently curved to the tip, where it is considerably decurved; gonys straight to near the angle, which is well defined, the outline from angle to tip perfectly straight. Feathers extending between the rami nearly to the angle. Wings long and pointed, reaching beyond the tail; primaries gradually attenuated to the tip. Color entirely pure white, the shafts of the primaries straw-yellow. Bill dusky greenish, yellow at tip and along the cutting edges. Legs and feet black. Eye brown, the edges of the eyelids red. Young: Front, chin, and sides of the head, grayish-dusky; the upper part of the neck, all round, irregularly spotted with the same. Scapulars, and upper and under wing-coverts, spotted with brownish-black, the spots most numerous along the lesser coverts. Tips of the primaries and tail-feathers with a dusky spot. Dimensions: Length 19.00; extent 41.00; wing 13.25; bill above 1.40; along gape 2.10; height at nostrils 0.45; tarsus about 1.45; middle toe and claw 1.75. Arctic seas of both hemispheres, coming southward in winter, but rarely to the U. S.

311. **CHROICOCE'PHALUS.** (Gr. *χρωικός, chroïkos*, colored; *κεφαλή, kephale*, head.) Hooded Gulls. Rosy Gulls. Form as in *Larus*, but general organization averaging less robust, size smaller, and bill usually weaker, slenderer, more acute and less hooked. Head enveloped in a dark hood in the breeding season, when white of under parts usually blushing pink or rosy. Markings of the primaries varying with the species, but different from that of the larger

gulls. Tail square, or nearly so. There are no marked peculiarities of form of this genus, the pattern of coloration being mainly its basis. The numerous species average much under those of *Larus* in size (though one at least is among the largest of *Larinæ*); they approximate toward *Xema* and *Rhodostethia* in some respects, but the tail is neither forked nor cuneate.

Analysis of Species.

Tarsus longer than middle toe and claw.
Bill reddish, feet the same. Length 16.00 or more . . . . . *atricilla* 786
Tarsus not longer than middle toe and claw.
Bill reddish, feet the same. Length about 14.00 inches . . . . . *franklini* 787
Bill black, feet red or yellow. Length about 14.00 inches . . . . . *philadelphia* 788

786. C. atricil'la. (Lat. *atricilla*, black-tail: only applicable to the young. Fig. 510.) LAUGHING GULL. BLACK-HEADED GULL. Bill longer than middle toe and claw, shorter than tarsus or head, moderately compressed, rather stout for this genus. Culmen and commissure both decurved at the end, the latter somewhat sinuate at the base. Gonys considerably concave in front of the angle, somewhat so between the angle and tip; although the angle is well defined, the tip of the bill is so decurved that a chord from tip to base does not touch it. Middle toe barely three-fourths the tarsus. Adult in summer: Bill and edges of eyelids deep carmine; legs and feet dusky-red; iris blackish. Hood deep plumbeous grayish-black, extending further on the throat than on the nape. Eyelids white posteriorly. Neck all round, rump, tail, broad tips of secondaries and tertials, and whole under parts, white, the latter with a rosy tinge (like the tint of peach-blossoms). Mantle grayish-plumbeous. Outer six primaries black, their extreme tips white; their bases for a very short distance on the first, and only on the inner web, and for a successively increasing distance on both webs of the others, of the color of the back. Adult in winter: Under parts simply white, not rosy; hood lost, the head being white, mixed with blackish. Bill and feet more dull in color. Immature: Bill and feet brownish-black, tinged with red. Plumbeous of the upper parts more or less mixed with irregular patches of light grayish-brown. Primaries wholly brownish-black, fading at the tip. Secondaries brownish-black on the outer web. Tail-feathers more or less tinged with plumbeous, and with a broad terminal band of brownish-black, the extreme tips of the feathers white. Upper tail-coverts white. Young-of-the-year: Entire upper parts, and neck all round, light brownish-gray; the feathers tipped with grayish or rufous-white, broadly on the scapulars and tertials, the blue of the adults appearing on the wing-coverts. Eyelids whitish; a dusky space about the eye. Forehead, throat, and under parts, dull whitish, more or less clouded with gray, especially on the breast, where this is the prevailing color. Wings and tail as before. Length about 16.50; extent 41.00; wing 13.00; tail 5.00; bill 1.75, along gape 2.25, its height at nostril 0.45; tarsus 2.00; middle toe and claw 1.50. Tropical Am. and temperate N. Am.; in the U. S. north coastwise in summer to Maine, in the interior to Ohio or beyond; on the Pacific side to California; Central America, both coasts, and various W. I. islands; S. Am. to the Lower Amazon; casual in Europe. By thousands along the Atlantic coast during the migrations, breeding in colonies anywhere along, wintering in the South. Nest on the ground, of eel-grass, seaweeds, and other vegetable material; eggs mostly 3, sometimes 2; 2.10 × 1.55; ground color some olive shade, ranging from dull grayish to dark greenish, thickly marked all over with spots and irregular splashes of brown, blackish, dull reddish and pale purplish; sometimes the markings chiefly wreathed about the large end.

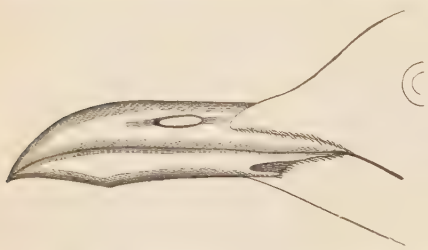


FIG. 510. — Bill of Laughing Gull, nat. size. (Ad nat. del. E. C.)

787. C. frank/lini. (To Sir John Franklin.) FRANKLIN'S ROSY GULL. Adult in breeding plumage: Bill rather slender, attenuated and a little decurved at the tip, which is acute; outline of both rami and gonys concave. Bill shorter than head; tarsus equal to middle toe and claw. Bill red (carmine, lake, or vermilion), crossed with black near the end. Legs dusky-reddish. Edges of eyelids orange. Eyelids white, this color also reaching a little behind the eye. Hood deep slaty or plumbeous-black, encircling the upper part of the neck as well as the head, and extending further on the throat than on the nape. Mantle not quite so dark as in *atricilla* (more blue), darker than in *philadelphia*. First primary with the outer vane black to within an inch of the tip; the inner pearly-white, crossed an inch or more from the tip by an isolated black bar an inch broad, thus leaving the feather white on both webs for an inch or more from the tip. The next five primaries are basally of the color of the back, paler on the inner web, and both webs fading toward their tips into white; each is crossed by a black bar near the end, two inches wide on the second primary, narrowing on successive feathers to a small bar or pair of little spots on the sixth; the tips of all these primaries pure white. Other primaries, with secondaries and tertials, colored like the back, fading at the tips into white; shafts white, sometimes black along the black portion of the feather. Tail very pale pearly-blue, the three lateral pairs of rectrices white — or rather tail white, lightly washed with pearly on the six central feathers. Neck all around, rump, broad tips of secondaries and tertials, and whole under parts white, the latter rosy. Younger, that is to say, in summer plumage, and with a perfect hood, red bill, etc., but the primaries not yet having attained their perfect pattern: General coloration exactly as before. Shafts of first three primaries black, of the rest gray, except along the black portion of the feathers; 1st primary with the outer web wholly black, the inner web pearly-gray, much like the back but lighter, to within two or three inches of the tip, then black for the rest of its extent; 2d like the 1st, but the base of the outer web like the inner; on the 3d, 4th, and 5th, successively, the black decreases in extent, till on the 6th it is merely a little bar, or pair of spots; tips of all the primaries white; that of the 1st primary smallest, that of the others successively increasing in size. Winter plumage: As in summer; the hood wanting or indicated by a few slaty feathers about the eyes, on the auriculars and nape; the rosy wanting; the bill and feet dull-colored. Young: Bill blackish, with pale base of under mandible; feet flesh-colored; eye black. Traces of a hood, or nape largely slaty, etc., according to precise age. Outer five or six primaries wholly black in their continuity, rather lighter and somewhat slaty at base, with or without a minute white speck at the tip. Mantle gray or brown, more or less mixed with blue, according to age. Tail ashy-white, with a broad black subterminal bar. Under parts white. This appears to be the usual plumage of birds of the first autumn. Dimensions: Length about 14.00 inches; extent 35.00; wing 11.25; tail about 4.50; bill along culmen 1.30; along gape 1.75; height at nostril 0.35; tarsus 1.60; middle toe and claw the same. Young smaller than adults; bill 1.10–1.20; wing 10.00, etc. S. and C. Am. in winter; in N. Am. migrating through the interior, chiefly west of the Mississippi, to the Arctic regions, abundant; has never been observed in the Atlantic States. Breeds from the N. border of the U. S. northward. Eggs 2.12 × 1.40, closely resembling those of the Eskimo curlew in size, shape and color; though the dark splashes are more evenly distributed over the surface.

788. C. philadel/phia. (To the city of that name.) BONAPARTE'S ROSY GULL. Adult, breeding plumage: Bill shorter than the head or tarsus, much compressed, very slender, like a tern's; both mandibles with a slight but distinct notch near the tip. Convexity of culmen slight, gradual from base to apex; rami slightly concave; gonys about straight. Nostrils very narrow. Tarsus equal to middle toe and claw. Tail somewhat emarginate in the young. Bill black. Mouth and eyelids carmine. Legs and feet coral-red, tinged with vermilion. Webs bright vermilion. Hood plumbeous-slate, not so deep as in *franklini*, enveloping the head and upper part of the neck, reaching further before than behind. White patches on eyelids

narrow, and half posterior to the eye. Mantle pearl-blue, much lighter than in *franklini*. Ends of the tertials and scapulars scarcely lighter than the back. Primaries: shafts of the first five or six white, except at their extreme tips, the others dark-colored; first, outer web and extreme tip black, rest white; second, white, its tip black for a greater distance than the first, and on one or both webs, for a greater or less distance (sometimes half way down the feather) narrowly bordered with black; third, fourth, fifth, sixth, black at the ends for about the same distance on each, the black bordering the inner web much further than the outer; the inner webs of the third and fourth, and both webs of the fifth and sixth, of a rather lighter shade of the color of the back. Other primaries like the back, the seventh and eighth with a touch of black on one or both webs near the tip. The third to sixth primaries with a white or pearly-white speck at extreme tip. As is not the case with either of our other species of the genus, the primary wing-coverts, bastard quills, etc., are wholly or in great part white, causing the whole wing to be bordered with white as far as the carpus. Neck all around, and under parts, including under wing-coverts, pure white; the belly rosy in breeding time. No difference in color between the sexes. Adult, winter plumage: Bill light colored at base below; feet flesh-color. Crescent before the eye, and patch below the auriculars, deep slate. Crown and occiput mottled with grayish-black and white. Back of neck washed over with the color of the mantle. Forehead, sides of the head and throat, white, continuous with the white of the under parts. Young, first winter: Bill dusky flesh-color, except toward the end; legs and feet light flesh-color. Without the slaty mottling of the crown. Auricular patch distinct. Lesser wing-coverts and tertials dusky-brown, lighter along their edges. Secondaries with a patch of dusky near the end, which on the innermost three or four becomes restricted to the outer web. First primary, with about half the inner web along the shaft, black; second and third with the outer webs wholly black, and a narrow line of black on the inner, along the shaft. Tail with a subterminal brownish-black bar. Very young: Bill flesh-color, dusky on the terminal half. Crown of head, and neck behind to the interscapulars, clouded with dusky bluish-gray, heightening on the sides of the neck into light grayish-ochreous. Scapulars and middle of the back light gull-blue, as in the adult, but the feathers so broadly (for ½ inch) tipped with grayish-brown, fading into dull white at tip, that the original color is nearly lost. Lesser wing-coverts and tertials brownish-black, the latter edged with the color of the edgings of the back. Bastard quills and feathers along the edge of the wing variegated with black and white. Primaries black; the outer two-thirds of the inner vane of the first four bluish-white to near the end; both vanes of the others of that color for a little distance; the extreme tips of all but the two first, white. Secondaries light gull-blue, each with a large terminal blackish spot continuous with the black ends of the inner primaries. Tail with a broad terminal bar of black, and very narrowly tipped with dull white. Dimensions: Length 14.00 inches; extent 32.00; wing 10.25; bill above, 1.20; gape 1.75; height at nostrils 0.25; tarsus, or middle toe and claw, 1.40. N. Am. at large, both coastwise and in the interior, migrating through and wintering in the U. S., breeding in high latitudes; abundant; especially numerous along the Atlantic coast during the migrations; accidental in Europe. One of the most airy, graceful, and elegant of the family. Eggs rare and scarcely known; one has been described as 1.80 × 1.30, olive-gray, with a close wreath of very dark and lighter brown splashes around the larger end, and other scratches and spots of the same scattered over the whole surface. In the interior this species and the last may often be seen winnowing over ploughed land, probably after earth-worms.

312. **RHODOSTETHIA**. (Gr. ῥόδον, *rhodon*, the rose; στῆθος, *stethos*, the breast.) Wedge-tail Gull. Tail cuneate (here only among *Laridæ*). Otherwise, form much as in other small gulls; bill weak and slender, with little salience of the angle; wings folding beyond the tail. No colored hood, but a black collar round neck. Under plumage blossoming in breeding season.

789. R. ro'sea. (Lat. *rosea*, rosy.) WEDGE-TAILED, *or* ROSS' ROSY GULL. Adult: White, rosy-tinted; a black collar, but no hood; mantle pearly-blue; primaries marked with black; bill black, gape and edge of eyelids red; feet vermilion. Length 14.00; wing 10.50; bill 0.75, very slender; tarsus little over 1.00; tail 5.50, *cuneate*, the graduation being one inch. Young extensively mottled with blackish. Arctic regions; a circumpolar species, chiefly inhabiting the Arctic coasts of N. Am. and Siberia, though known to come southward to the Færoes and Heligoland in Europe, and to St. Michael's in Alaska. This exquisite gull, famed for the beauty of its plumage, remained until recently one of the rarest of birds in collections; only about a dozen being known to exist, not one of them in any American museum. In 1879, Mr. R. L. Newcomb, naturalist of the ill-fated "Jeannette," secured eight specimens on the Siberian coast, only three of them, however, being preserved. Mr. E. W. Nelson took one at St. Michael's, Alaska. More recently, a very large number of specimens have been secured at Point Barrow, on the Arctic coast of Alaska.

313. XE'MA. (A nonsense word — *sonus sensu carens.*) FORK-TAIL GULLS. Tail forked (here only in *Larinæ*). Head hooded, with a more or less evident darker collar. Bill black, with light tip. Size moderate and small. With a general bearing toward *Chrŏïcocephalus*, in the hooded head and other features, the genus is distinguished from this or any other group of *Larinæ* by the tern-like character of the forked tail.

Analysis of Species.

Small: Wing 11 inches or less; tail lightly forked; a definite black collar bounding the hood; feet black *sabinii* 790

Large: Wing 16 inches or more; tail deeply forked; black collar inconspicuous; feet reddish . . *furcata* 791

790. X. sabi'nii. (To E. Sabine.) FORK-TAILED GULL. Adult, breeding plumage: Bill black to the angle, abruptly bright chrome from angle to tip. Mouth bright orange; eyelids orange; legs and feet black. Hood uniform clear deep slate, bounded inferiorly by a ring, narrowest on the nape, of velvety-black. Lower part of neck all round, tail and its coverts, four inner primaries, secondaries, greater part of greater coverts, tips of tertials except the innermost, and whole under parts, pure white. Mantle slate-blue, extending quite to the tips of the inner tertials. Edge of wing from the carpal joint with the bastard wing, black. First five primaries, with their shafts, black; their extreme tips, and the outer half of the inner webs, to near the end, white. Other primaries white, the sixth with a touch of black on the outer web. Emargination of tail 1.25 inches. Length 13.75; wing 10.75; bill 1.00; along gape 1.50; height at angle 0.30; tarsus 1.25; middle toe and claw same. Adult in winter: Without the hood. Young-of-the-year: Tail forked, nearly as in the adult. Bill small and weak, flesh-color and dusky. Legs apparently flesh-colored. No hood nor collar. Most of the head, the back of the neck, and upper parts in general, slaty-gray, transversely waved with brownish-white; each feather being tipped with this color. Under parts white. Tail white, with a broad terminal bar of black, an inch wide on the central rectrices, growing narrower on the others successively; on the outermost sometimes invading only one web. This black bar very narrowly edged with white. Wings surprisingly similar to those of the adult, but the white on the inner webs more restricted, and the white tips very small or wanting altogether. Dimensions a little less than those of the adult. Young not distinctly resembling the same age of *Ch. philadelphia*. Arctic America, both coastwise and in the interior, irregularly south in winter through the U. S.; Bermudas; Peru! Europe. Common enough in high latitudes, but seldom seen in the U. S., and still rather rare in collections. Eggs 3, 1.75 × 1.25, much like a curlew's in general aspect, brownish-olive, sparsely splashed with brown.

791. X. furca'ta. (Lat. *furcata*, forked.) SWALLOW-TAILED GULL. Immature? Head and nearly all the neck grayish-brown; a white mark on each side of the forehead: mantle grayish-white; tail white, much forked; lesser wing-coverts white; greater slate, white-bordered;

bill black at base, white at end; eyes and feet red; eyelids orange; claws black. Length about 2 feet. "California" (?) The foregoing is compiled from the original description. Only three specimens of this excessively rare gull are known: one ascribed to Monterey, California; another, adult, from Chatham island, one of the Galapagoes. The latter, in the British Museum, is thus described: "Head, neck, and throat, of a sootier color than in *X. sabinii*, darkening toward the base of the hood, but not forming a distinct black collar, as in this species; a white frontal band; under parts and tail pure white, the latter more deeply forked than in *sabinii;* mantle pale pearl-gray, somewhat darker on the wing-coverts; primaries blackish-brown on outer webs and continuation of inner webs, thence white, except at tip; secondaries white, tinged with gray at their tips; bill blackish, tipped with horn-yellow from the angle. Wing 16.50 inches; tarsi nearly 2 inches; middle toe the same; hind toe very small, but bearing a well-developed claw." A third has lately been announced from Paracas Bay, Peru; this is a young one, with black bill, reddish feet, the mantle spotted and the tail barred with blackish. Adult and young are figured by Saunders, P. Z. S., 1882, p. 523, pl. 34; see also P. Z. S., 1878, p. 210. The species is very questionably N. Am.

72. Subfamily STERNINÆ: Terns.

FIG. 511.—Roseate Tern. (From Tenney, after Audubon.)

Covering of bill continuous (no cere), hard and horny throughout. Bill *paragnathous*, relatively longer and slenderer than in the gulls, very acute, the commissure straight or nearly so to the very end. Curve of culmen gentle and gradual from base to apex. Symphysis of inferior mandibular rami much more extensive than in *Lestridinæ* or *Larinæ*, but the eminentia symphysis less marked. Interramal space narrow. Encroachment of feathers on the bill as in *Larinæ*. Nostrils linear-oblong, lateral, direct, pervious, varying with genera as regards degree of approximation to the base of the bill. Wings extremely lengthened, narrow, and acute, the first primary much the longest, the rest rapidly graduated. Secondaries short and inconspicuous. Tail usually much elongated and deeply forked, the lateral feathers being more or less attenuated and filiform; only occasionally short and broad (*Gelochelidon*), or graduated (*Anoüs*, etc.). Legs placed rather further back, and less decidedly ambulatorial than in *Larinæ*. Tibia denuded for a varying distance. Tarsi short and usually slender; scutellate and reticulate, as in *Larinæ*. Toes of moderate length, and of the usual relative proportions. Webs rather narrow, and (except in *Anoüs*, etc.) more or less incised. Claws small, compressed, but much curved and acute. Size moderate, or very small. General form slender and delicate. Plumage as in other subfamilies, but the pterylæ narrow; the sexes hardly differing in coloration, but the variations with age and season very great.

The terns are not distinguished from the gulls by any strong structural peculiarities, but they invariably show a special contour, in the production of which the longer, slenderer, and acutely paragnathous bill is a conspicuous element. Only one species has the bill in any noticeable degree like that of a gull. A few of the terns are as large as middle-sized gulls, but the normal stature is much less; and they are invariably of a slenderer build, more trim in shape, with smoother, closer-fitting plumage. The great length and sharpness of the wing relative to the bulk of the body confer a dash and buoyancy of flight wanting in the gulls; in flying over the water in search of food, they hold the bill pointing straight downward, which makes them look curiously like colossal mosquitoes; and they secure their prey by darting impetuously upon it, when they are usually submerged for a moment. The larger kinds feed principally upon little fish, procured in this way; but most of the smaller ones are insectivo-

rous, and flutter about over marshy spots like swallows or night-hawks. The general appearance and mode of flight have suggested the name of "sea-swallow," the equivalent of which is applied in nearly all civilized languages. A forking of the tail is an almost universal character. In the Caspian and marsh terns, the black tern and its allies, and some others, the forking is moderate, and not accompanied by attenuation of the lateral feathers; but ordinarily, these are remarkably lengthened and almost filamentous, as in the barn swallow. It should be observed that in all such cases the narrowing elongation is gradual, and consequently less evident in the young; and that it is very variable in its development. The noddies offer the peculiarity of a tail lightly forked centrally, but rounded laterally. The feet are small and relatively weak throughout the group; the terns walk but little, and scarcely swim at all. Ordinarily the webbing is rather narrow, and incised, particularly that between the middle and inner toe; in *Hydrochelidon*, this occurs to such extent that the toes seem simply semipalmate. The webs are fullest in *Anoüs*, where also the hallux is unusually long; in some species, this toe is slightly connected with the tarsus by a web. The inner toe is shorter than the outer, and much less than the middle, which, especially in *Hydrochelidon*, is much lengthened, and has the inner edge of its claw dilated, or even slightly serrate. The coloration is very constant, almost throughout the subfamily. Most of the species are white (often rosy-tinted below), with a pearly-blue mantle, a black cap on the head, and dark-colored primaries, along the inner web of which *usually* runs a white stripe. These dark-colored quills, when new, are beautifully frosted or silvered over; but this hoariness being very superficial, soon wears off, leaving the feathers simply blackish. The black cap is often interrupted by a white frontal crescent; it is sometimes prolonged into a slight occipital crest; in a few species, it is replaced by a black bar on each side of the head. One species, *Inca mystacalis*, has a curious bundle of curly white plumes on each side of the head. Another, *Gygis alba*, is pure white all over; *Procelsterna cinerea* is wholly ashy; the noddies are all fuliginous; the upper parts of *Haliplana* are dark; the species of *Hydrochelidon* are largely black. These are the principal if not the only exceptions to the normal coloration just given. The sexes are never distinguishable, either by size or color; but nearly all the species, in the progress toward maturity, undergo changes of plumage, like gulls; while the seasonal differences are usually considerable. As a rule, the black cap is imperfect in young and winter specimens, and the former show gray or brown patching instead of the pure final color of the mantle. In all those species in which the bill is red, orange, or yellow, it is more or less dusky in the young. The changes are probably greatest in the black terns.

The general economy is much the same throughout the group. The eggs are laid in a slight depression on the ground, — generally the shingle of beaches, or in a tussock of grass in a marsh, or in a rude nest of sticks in low thick bushes; they are 1–3 in number, variegated in color. Most of the species are maritime, and such is particularly the case with the noddies; but nearly all are also found inland. They are noisy birds, of shrill penetrating voice; and no less gregarious than gulls, often assembling in multitudes to breed, and generally moving in company. Species occur near water in almost every part of the world, and most of them are widely distributed; of those occurring in North America, the majority are found in corresponding latitudes in the Old World. Some seventy species are currently reported; the true number is apparently just about that of the Gulls (about fifty).

The generic and subgeneric groups of the *Sterninæ* are rather better marked than those of the *Larinæ*. *Phæthusa*, *Gygis*, and several subgenera near *Anoüs* are extralimital. The North American forms may readily be distinguished by the following analysis. *Hydrochelidon* and *Anoüs* may be regarded as genera, the remainder being subgenera of *Sterna*.

Analysis of the North American forms of Sterninæ.

Nostrils sub-basal. Frontal antiæ prominent, embracing base of culmen. Tail more or less forked. Tarsus not shorter than middle toe without the claw. Lateral toes much shorter than the middle.

Webs incised (Group STERNEÆ).
Webs moderately incised. Tail well-formed, generally more than half as long as the wing. Under parts white or light.
Upper parts pearl-gray. Cap in summer black, or a black bar through eye.
Bill short and very stout, somewhat gull-like, black. Tarsi much longer than the toes, black. Tail lightly forked. Medium size . . . . . *Gelochelidon*
Bill long, large, bright colored, or with yellow tip. An occipital crest. Feet black. Forking of tail variable. Of large size . . . . . *Thalasseus*
Bill moderate, slender, usually bright colored, like the feet. No crest. Tail long, deeply forked. Size medium and small . . . . . *Sterna* 314
Upper parts dusky. Cap like the back.
Bill and feet black. A white frontal crescent . . . . . *Haliplana*
Webs deeply incised (feet little more than semipalmate). Tail merely emarginate, hardly or not half as long as the wing. Under parts in summer black . . . . . *Hydrochelidon* 315
Nostrils nearly median. No frontal antiæ, the feathers extending further on culmen than at the sides. Tail double-rounded. Tarsi very short. Toes lengthened, the lateral nearly as long as the middle, with full webs. (Group ANOEÆ.)
Color fuliginous . . . . . *Anoüs* 316

314. STERNA. (Latinized from English *stern* or tern.) TERNS. Form typical of the subfamily. Nostrils sub-basal. Frontal antiæ prominent. Tail more or less forked. Tarsus not shorter than middle toe without claw. Lateral toes much shorter than middle. Webs moderately incised. Under parts of adult white, or like back. (Characters of the subfamily, exclusive of *Hydrochelidon* and *Anoüs*.)

Analysis of Subgenera and Species (adults).

GELOCHELIDON. Bill very stout, almost gull-like, black. Tarsus much longer than toes, black. Tail lightly forked, contained about 2½ times in wing. Size moderate.
Head crested. Cap black. Pearly mantle extending over rump and tail . . . . . *anglica* 792
THALASSEUS. Bill long, large, tern-like, bright colored or with yellow tip. Feet black. Head crested. Size large to largest.
Tail merely emarginate, contained nearly or about 3 times in wing. Primaries without white space on inner webs. Bill red. Largest: wing about 16.00; tail 5.50; bill nearly 3.00 . . . . . *caspia* 793
Tail forked. Primaries with white space on inner webs. Bill orange, stout, about 2.50, 0.50 or more deep at base; gonys about 1.00 long. Wing 14.50 . . . . . *maxima* 794
Tail forked. Primaries with white space on inner webs. Bill orange, slender, about 2.50, under 0.50 deep at base, gonys about 1.50 long. Wing 12.50 . . . . . *elegans* 795
Tail deeply forked, with narrow outer feathers. Primaries with white space on inner webs. Bill slender, black, yellow-tipped . . . . . *cantiaca* 796
STERNA proper. Bill long, slender, acute. Tarsus not longer than middle toe and claw. Tail more or less forked, with acute or very narrow lateral feathers, one-half or more as long as wing. Head not decidedly crested. Size medium to smallest.
Mantle pearly-blue.
No black cap.
Head whitish, with black bar through eye; under parts like the mantle . . . . . *trudeaui* 802
A black cap.
No white frontal crescent; black cap reaching bill.
Bill wholly or mostly red or reddish.
Bill red, blackening at end; feet coral-red. Outer web of outer tail-feather white; inner gray or dark. Tarsus 0.90 or more . . . . . *forsteri* 798
Bill red, blackening at end; feet coral-red. Outer web of outer tail-feather gray or dark, inner white; under parts paler than upper. Tarsus about 0.75 . . *hirundo* 797
Bill wholly red; feet vermilion; outer tail-feather as in the last. Tarsus 0.65 or less. Under parts nearly like upper . . . . . *macrura* 799
Bill black, or only red at base. Feet reddish . . . . . *dougalli* 800
A white frontal crescent.
Bill yellow, tipped with black. Feet yellow . . . . . *antillarum* 801
Bill and feet black . . . . . *aleutica* 803
Mantle dusky. A white frontal crescent. Bill and feet black. (HALIPLANA.)
Mantle blackish-brown; cap the same . . . . . *fuliginosa* 804
Mantle sooty-gray; cap black . . . . . *anæsthetica* 805
OBS. Above analysis based on adult summer birds, and not entirely available for young and winter ones, in which the chars. of the cap, and colors of bill and feet, may be entirely different. These must be determined by reference to the detailed descriptions.

792. **S. (G.) an'glica.** (Lat. *anglica*, Anglican, English.) GULL-BILLED TERN. MARSH TERN. ♂ ♀, in summer: Bill rather shorter than head, robust, not very acute, compressed; culmen nearly straight to beyond nostrils, then very declinato-convex to the tip; gonys about straight; rami slightly concave; symphyseal eminence well marked; tomia of lower mandible inflected; commissure gently curved. Height of bill at base a third of total length. Nasal groove short and broad, not deep; nostrils short, widely oval, placed very near base of bill, just beyond the termination of the feathers. Wings exceedingly long and acute, each primary surpassing the next by a full inch; the secondaries short, soft, obliquely incurved at their extremities. Tail short, contained 2½ times in the wing; deeply emarginate, but its lateral feathers not elongated nor attenuated. Feet long and stout for this subfamily. Tarsus shorter than bill, longer than middle toe and claw. Hind toe remarkably developed; inner shorter than outer; interdigital membranes deeply incised, especially the inner. Tibia naked for half an inch. Crown and long occipital crest glossy greenish-black, extending on to lower border of eye, leaving only a very narrow line of white to run along the edge of the feathers on side of upper mandible. Neck all round and under parts, white. Mantle light pearl-blue, this color extending on rump and tail, quite to the tips of the rectrices; tail-feathers, indeed, deepest colored at their tips, fading into nearly pure white toward their bases, on that portion of each feather which is covered with the next one. The color of the mantle extends quite to tips of tertials, but dilutes a little toward the tips of the secondaries. Shafts of primaries yellowish-white. Primaries all grayish-black, deepest on the outer vane of the first; but this color so heavily silvered as to appear much lighter. All the primaries have on their inner webs a space of white, which extends toward their apices for a varying distance on each; on the first the white is largest, purest, and extends furthest; is distinctly defined from the black, and has not a margin of black along its inner border, except just at its apex. The amount of the white diminishes in length and breadth with each successive primary, until on the last one it is inconspicuous; still it is quite perceptible on all. Bill black, with or without a minute yellowish tip; legs and feet greenish-black; iris brown. In winter: Differs in restriction of the black cap, chiefly to the hind head and nape, on sides of head reaching forward to eye; sometimes extinct, except in dusky eye-stripe and spot before eye, when whole head otherwise white. Young: Bill blackish-brown, pale at base below; feet dull brownish. Upper parts pearl-blue, interrupted by numerous crescentic or hastate spots of dull brownish, one on each feather, the extreme tip of which is whitish. A brownish-black bar along lesser wing-coverts. Forehead and most of crown white, with dark shaft-lines, increasing to exclude white on hind head and nape; blackish spot before and behind eye. Neck all around, upper tail-coverts, and whole under parts, white. Tail-feathers whitening at ends, each with a dusky space. Length 13.00–15.00; extent 33.00–37.00; bill 1.40; along gape 2.00; its height at base 0.45; tibiæ naked 0.50; tarsus (average) 1.30; middle toe and claw 1.10; hind toe and claw 0.40; wing 11.75–12.25; tail 5.50, forked 1.20–1.75. Nearly cosmopolitan; in N. Am., not abundant, and chiefly in Eastern U. S., Texas to New England. Not a beach-nester; breeds in marshes, like the black tern; eggs 3, laid on broken-down reeds or grasses, 1.75 × 1.30, olivaceous, largely and irregularly splashed with umber-brown and blackish, especially about the largest part, but very variable, like all terns' eggs.

793. **S. (T.) cas'pia.** (Of the Caspian Sea. Fig. 512.) CASPIAN TERN. IMPERIAL TERN. Of maximum size. Length 20.00–23.00; extent 50.00–55.00; wing 15.00–17.00, usually about 16.00; tail only 5.00–6.00, forked about 1.50, middle feathers broad to their rounded ends, rest growing successively more acute, but lateral *without* any slender filamentous development. Bill extremely large, 2.75 along culmen, 4.00 along gape, 0.90 deep at base, 0.50 wide at nostrils; about as long as head, with culmen regularly curved from base to tip; outline of mandibular rami slightly concave; gonys about straight; angle not very well marked.

Tibiæ bare about 0.75; tarsus 1.75, rather exceeding middle toe and claw, the scutella in front replaced by polygonal scales similar to but larger than those on its sides, which are rough; hind toe extremely small; outer lateral nearly as long as middle toe and claw, which is 1.65. Bill dark vermilion red, growing lighter and somewhat "diaphanous" toward the tip. Pileum and occipital crest glossy greenish-black, extending to below the lower level of the eyes, and occupying the termination of the feathers on the side of the mandible to the

FIG. 512. — Caspian Tern, ⅛ nat. size. (From Brehm.)

exclusion of the white; lower eyelid white, forming a noticeable spot on the greenish; a white streak along sides of upper mandible, *not* extending to the end of the feathers. Mantle pearl-blue, the line of demarcation between it and the white rather indefinite, both on nape and rump; most of the tail-feathers, and especially the central ones, retaining a more or less pearly tint. Shafts of the primaries yellowish-white; primaries grayish-black, but, when new, so heavily silvered over as to appear of a light hoary gray, especially on their superior aspects. On the inner web of all there is a central light field; this is very narrow, even on the first primary, although it runs for some considerable distance, and on the others it rapidly grows less; and it has no trenchant line of division on any of the primaries from the darker portions of the feather. Whole inner web of secondaries pure white, outer pearl-blue. Legs and feet black. Adult, winter plumage: Chiefly distinguished by a diminution in the brightness of the bill, and by a change in the character of the pileum. The vermilion is replaced by light orange-red, growing still yellower toward the tip of the bill and along the tomia.

The forehead is white, usually quite pure; crown white, with small, narrow, distinct streaks of brownish-black, along the shaft of each feather. On the sides of the head, before and behind the eyes, and over the auriculars, the black is more largely intermixed with the white; and on the nape of the neck, that is, toward the termination of the occipital crest, the black is the predominating color, being only slightly variegated with white. Young-of-the-year: Everyway much smaller than the adult, the bill especially smaller, shorter, and weaker, and of a duller red, more inclining to orange. Upper parts as in the adult, but the pearl-blue everywhere spotted with rather small roundish or hastate spots of brownish-black, largest on the tertials. Forehead grayish-white; vertex speckled with grayish-white and black, the latter color increasing in amount until it becomes nearly or quite pure on the short occipital crest. Wings much as in the adult. Tail much shorter and less forked; the rectrices with brownish spaces near their tips, chiefly on their inner webs. Under parts dull white. Legs and feet rather shorter and weaker than those of the adult, but of much the same color. Downy young: Grayish-white above, faintly mottled with blackish not aggregated into spots; white below, dusky across throat. Northern Hemisphere: In N. Am. irregularly distributed, chiefly in Arctic regions, and along whole Atlantic coast; has lately occurred in various localities in the Mississippi and Ohio valleys; known to breed on coasts of Virginia and Texas. Eggs 2, in hollow scooped in dry sand without nest, 2.65 to 2.75 × 1.80 to 1.90, broader and more elliptical than those of *S. maxima*, with smoother and harder shell; ground-color pale olive-buff, evenly marked all over with small spots of dark-brown and lavender. Breeds commonly by single or few pairs, not in great colonies like *S. maxima*.

794. S. (T.) maxima. (Lat. *maxima*, largest: not true. Fig. 513.) Cayenne Tern. Royal Tern. Bill about as *long* as that of *S. caspia*, but of very different shape, much slenderer, its height at base only from a fourth to a third of its length. Culmen gradually declinato-convex from base to tip, the amount of curvature increasing but slightly toward the apex, which is not very acute. Commissure somewhat sinuate basally, regularly declinato-convex for the rest of its length. Rami decidedly a little concave along their edges. Gonys straight, shorter than the rami, the prominence between the two illy developed. Tibiæ bare for a considerable distance (0.90 of an inch). Tarsus not longer than middle toe and claw; its anterior aspect shows a tendency toward reticulations instead of transverse scutella, but there are usually some scales which extend quite across it. The lateral and posterior aspects are thickly reticulated, as in *caspia*, but the plates are not so rough nor elevated. Tail long for this subgenus, quite deeply forked; central feathers broad to their very tips, which are rounded; lateral ones successively more elongated and narrower toward their tips, the external pair slender and quite filamentous for some distance. Adult in summer: Pileum glossy greenish-black, not extending below eyes, so narrow on side of upper mandible that a broad white streak extends to extreme tip of the feathers. Mantle exceedingly light pearl-blue, fading imperceptibly into white on the rump and toward the extremities of the tertials. Tail white, with a faint tinge of pearly, especially on the central feathers and inner webs of the others. Secondaries pure white for their whole length except a small space on the outer web near the tip, which is grayish-blue, deeper than the mantle. Outer web of first primary grayish-black; the inner web of the same has a space of black

Fig. 513. — Royal Tern, ⅔ nat. size. (From Sclater and Salvin.)

extending the whole length of the feather, very narrow at the base, widening as it runs toward the tip, within 1½ inches of which it occupies the whole web; the rest of the web white, separated from the black by a straight distinct line of division. The second, third, fourth, and fifth primaries have the same general characteristics, but the white space rapidly grows narrower and shorter, and runs up further in the centre than along the edge of the web, so that for a little way from its end it has a border of blackish along its outer margin; other primaries wholly pearl-blue, their inner webs margined with white. Bill coral or orange-red, with a slightly lighter tip; feet blackish, their soles dull yellowish. Winter plumage: Bill less brightly colored, its apex and tomia dull yellowish. Front white; crown variegated with black and white, the former color increasing on the occiput and nuchal crest, which latter, though shorter than in summer, is almost or quite unmixed with white. This black extends forward on the sides of the head to the eye, which it includes. (But frequently found breeding in this imperfect condition of the black cap, which is *much* more usual than the complete black.) Tail not pure white, but glossed over with the bluish of the mantle, which deepens toward the tips of the feathers into dusky-plumbeous; also considerably less forked, the lateral feathers having little or nothing of a filamentous character. Young-of-the-year in August: Bill considerably smaller and shorter than in the adult; its tip less acute, and its angles and ridges less sharply defined; mostly reddish-yellow, but light yellowish at tip. Crown much as in the adults in winter, but the occipital crest scarcely recognizable as such. Upper parts mostly white; but the pearl-gray of the adults appearing in irregular patches, and the whole back marked with small, irregularly shaped, but well-defined spots of brown. On the tertials the brown occupies nearly the whole of each feather, a narrow edge only remaining white. Lesser wing-coverts dusky plumbeous. Primaries much as in the adults, but the line of demarcation of the black and white wanting sharpness of definition. Tail basally white, but soon becoming plumbeous, then decidedly brownish, the extreme tips of the feathers again markedly white. Otherwise as in the adults. Dimensions of the adults: length 18.00–20.00; extent 42.00–44.00; wing 14.00–15.00; tail 6.00–8.00; the depth of forking 3.00–4.00; bill, along culmen, 2.50 to 2.75; along commissure 3.75; its height at base 0.70; its width 0.50; gonys 1.00–1.25; tibiæ bare 0.90; tarsus 1.37; middle toe and claw 1.40. Tropical and temperate America; Brazil and Peru to California and New England, chiefly coastwise, sometimes in the interior, as in Nevada. A fine species, second in size only to *S. caspia;* linear measurement nearly as great as in that species, owing to elongation of tail, but bulk much less. Breeds in great colonies along our Atlantic coast, dropping 2 eggs on the sand, 2.67 long, as much as in *caspia*, about 1.70 or less broad, narrower and especially more pointed than those of *caspia*, rougher, yellowish-drab irregularly blotched with dark umber and pale purplish. Chicks spotted boldly above with dusky.

Fig. 514. — Elegant Tern, ⅔ nat. size. (From Sclater and Salvin.)

795. S. (T.) e'legans. (Lat. *elegans*, choice. Fig. 514.) Elegant Tern. Princely Tern. Similar to the last; smaller and differently proportioned; bill as long, much slenderer; tarsus if anything longer than middle toe and claw; mantle very pale; under parts rosy in high plumage Bill much longer than head, exceeding the tarsus, middle toe and claw together; much compressed, very slender, scarcely ⅓ as deep at base as long; culmen quite straight to beyond nostrils, then slightly convex for the rest of its length; commissure declinato-convex for nearly its whole length; mandibular rami very short, decidedly concave in outline, their angle of divergence very acute. Gonys extremely long, exceeding the crura of the mandible, its outline straight.

Tomia of both mandibles sharp and much inflected. Nasal groove long, fully half the culmen, narrow, not deep, directed obliquely downward and forward toward the tomia. A few oblique indistinct striæ on both mandibles. The outline of the feathers on the bill is as usual. Adult in summer: Bill bright red, salmon-colored toward tip. Feet black; soles and under surfaces of claws slightly yellowish. Crown of head, including long-flowing occipital crest, pure black, reaching down on the sides of the head to a straight line just on a level with the lower border of the eye; the white of the cheeks accompanying the black to the foremost point of extension of the feathers in the nasal fossæ. All the under parts rosy-white, with satin gloss. Tail entirely pure white, longer and more deeply forked than in winter. Back and wings pale pearl-blue; the usual pattern of coloration of the primaries. "Length 19; extent 48" (label); culmen 2.75; gape nearly 4.50; depth of bill at base 0.50; gonys 1.50, not shorter than mandibular rami; wing 12.25; tail 7.50; depth of fork 3.50; tarsus 1.25; middle toe and claw the same, or rather less. In winter: Bill orange, fading to yellow at tip and along cutting edges. Forehead and feathers on side of bill entirely white; crown varied with dark and white, black prevailing on hind head, complete on the occipital crest and sides of head to eyes. No pink blush of under parts. Tail shorter than in summer, 5.00 or less, forked only about 2.00, washed over with pearly-blue. Total length less, owing to less development of tail, 16.00–17.00. Young not seen. A truly elegant species, resembling the royal tern, but easily distinguished. S. and C. Am. to California; unknown on our Gulf or Atlantic coast.

796. S. (T.) cantiaca. (Of Kent, England. Fig. 515.) SANDWICH TERN. DUCAL TERN. Bill much longer than head, exceeding the tarsus, middle toe, and claw together; quite slender and attenuated for this subgenus, tip excessively acute; convexity of culmen, from tip to base, regular, but slight; commissure gradually declinato-convex throughout; outline of mandibular crura decidedly concave; that of gonys about straight; eminentia symphysis hardly appreciable. Adult, breeding plumage: Bill black, the tip for ½ to ¾ of an inch bright yellow, sharply defined against the black; "inside of mouth deep blue." Feet dull black. Pileum and occipital crest glossy black, with a tinge of green; the color extending just below the eyes, but leaving a space along the side of the mandible white to the extremity of the feathers. Mantle exceedingly light pearl-blue, fading on the rump and upper tail-coverts into pure white; but the rectrices themselves have a slight shade of pearly-bluish. Primaries colored as in *maxima*. On the inner web of the first the black space is broad and deep in color; when about 1½ inches from the apex of the quill it quite suddenly grows wider, so as to exclude the white portion from the tip altogether. The second, third, and fourth primaries have the same general pattern, but the white runs up further on the central portion than on the edge of the web, so that toward its end it receives a narrow edging of blackish. The other primaries have no blackish, but are simply pearl-blue, with broad white margins along the whole length of their inner webs. The outer primaries are all heavily silvered when the quills are new. Dimensions of the adult: length 15.00–16.00 inches; extent 34.00; wing from the carpus 12.50; tail 6.00; depth of emargination 2.35; bill along culmen 2.25; along gape 3.00; its height at base 0.48; width, ditto, 0.37; length of rami from feathers on side of lower mandible 1.00; gonys 1.20 (longer than rami); tarsus 1.00; middle toe and claw, slightly longer. Adult, winter plumage: Yellow

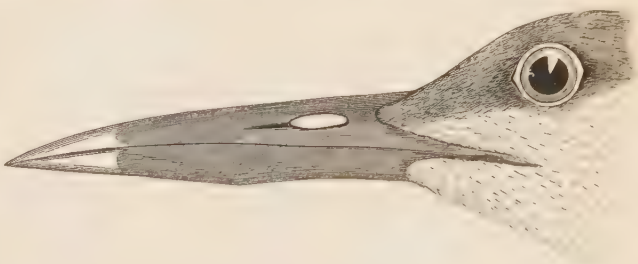


FIG. 515. — Sandwich Tern, nat. size. (Ad nat. del. E. C.)

tip of bill less in extent and intensity of color; front white, either pure or speckled with black; crown variegated with black and white, the former color consisting of small, narrow, distinct streaks along the shaft of each feather; but the long occipital crest, which does not entirely disappear at this season, usually remains of an unmixed brownish-black. Lateral tail-feathers shorter than in summer. Young-of-the-year: Considerably smaller than the adult, as is usual in this subfamily, the wing being a full half-inch shorter. Bill shorter and weaker, and without sharply-defined angles and ridges, brownish-black, the extreme point only yellowish. Crown, front, and occiput brownish-black, variegated with white; white touches very small on the forehead. Upper parts as in adult, but everywhere marked with irregularly-shaped but well-defined spots and transverse bars of brownish-black. No well-formed occipital crest until after the first moult. Primaries like those of adult. The tail, however, is very different. The feathers for three-fourths their length are of the color of the back; this color gradually deepens, until toward the tips it becomes brownish-black, each feather having a terminal irregular edge left whitish. Tail simply deeply emarginate, the outer feathers being but slightly longer than the second. A fine species, alone among the large terns, with its black yellow-tipped bill, of wide distribution in both Hemispheres; in N. Am. observed along Atlantic coast, New England to Texas; both coasts of C. Am.; S. Am. Eggs 2–3, dropped on the dry sand; 2.10 × 1.40; rather pointed, yellowish-drab, most irregularly spotted with dark brown and reddish-brown, with lilac shell-spots. Breeds in large colonies, like most terns.

797. S. hirun'do. (Lat. *hirundo*, a swallow.) COMMON TERN. WILSON'S TERN. SEA SWALLOW. Adult, summer plumage: Bill as long as head, about equalling tarsus and middle toe without claw, of moderate robustness; height at base contained a little more than five times in length of culmen; gonys as long as rami, measured from feathers on side of mandible to eminentia symphysis, which latter is but slightly marked; bright coral, or light vermilion, on basal half or rather more, the remainder black, except the extreme tips, which are yellowish. Pileum lustrous velvety-black, with tinge of glossy-green; it extends to lower level of eyes, but leaves the lower lids white, and it is so broad on the lores that the white line of feathers along side of mandible hardly reaches to their extremity. Whole upper parts pearl-blue, this color commencing insensibly on back of neck, deepening on dorsum, and extending quite undiluted almost to the extreme apices of the tertials; ending abruptly and distinctly on rump, the upper tail-coverts being pure white. Under parts of a considerably lighter shade of the color of the back. On the throat, toward the chin and along the borders of the black pileum, it fades into nearly or quite pure white, as it does also on the lower tail-coverts and the circumanal region; inferior surfaces of wings and axillary feathers pure white. Shafts of all the primaries white, deepening into blackish toward their apices. Outer web of first primary black, with scarcely any hoariness. The first four or five primaries are grayish-black, with a very strong silvery hoariness; their inner webs with a space of white along their inner margins. This space on the first primary at the base occupies the whole web, becomes narrower as it ascends, and ends, or becomes a mere line, about an inch from the apex of the quill. On the other primaries it is of less extent, and runs up along the centre of the shaft a little further than on the edge. On the innermost primaries, again, it is very narrow, but forms an entire margin to the inner webs, running quite to their tips. The inner primaries have scarcely any grayish-black, but are rather of the color of the mantle. Secondaries mostly pure white, but toward their ends have a space grayish-blue of about equal extent on both webs. Tail moderately elongated and forked, contained about $1\frac{2}{3}$ times in the wing; the folded wings reach one to two inches beyond it; central feathers broad to their evenly rounded tips; the lateral ones successively narrower, more tapering and acute; their *outer* webs light pearl-gray (very like the back), their *inner* webs nearly pure white. The external pair, however, are on most of their inner webs, especially terminally, grayish-blue, while their outer webs are dark grayish-black. Legs and feet light coral-red. Dimensions: length (average)

14.50 inches; extent about 31.00; wing from the carpus 10.50; tail 6.00; depth of fork 3.50 (average); bill along culmen 1.35; height at base 0.33; from feathers on side of lower mandible to tip 1.60; gonys 0.80; gape 2.10; tibiæ bare 0.50; tarsus 0.80 to 0.85; middle toe 0.75, its claw 0.30; outer 0.70, its claw 0.18; inner 0.48, its claw 0.14; hallux with its claw 0.28; whole foot about 1.75. Extreme range: length 13.00 to 16.00; extent 29.00 to 32.00; wing 9.75 to 11.75; tail 5.00 to 7.00; tarsus 0.66 to 0.87; bill 1.25 to 1.50. Females average a little less than the males. Young fall under the above minima; length down to 12.00, wing to 9.00, tail to 4.00, bill to 1.12, etc. Young-of-the-year in August: Upper mandible brown, becoming blackish on the culmen toward the tip, and somewhat flesh-colored basally along the tomia. Under mandible light yellow, darkening into brown toward tip. Mouth yellow; feet dull yellow, with scarcely a tinge of reddish. Forehead grayish-white; on the vertex this gray intermixed with large, roundish, illy-defined spots of blackish; on occiput and nape black is the prevailing color, the extreme tips of the feathers only being gray; on sides of head, as far as eyes, the black also nearly pure. The ground-color of the upper parts is a rather lighter shade of the pearl-blue of the adults, but every feather is tipped with dull light gray, and has a subterminal spot (generally a crescent or semicircle) of light brown. These spots and tips are quite conspicuous, and give perhaps the predominating color to the upper parts; but they are not so distinctly defined, nor so dark, as in *macrura*. Lesser wing-coverts along the edge of the fore-arm form a continuous band of nearly pure brownish-black. Lesser and median coverts are conspicuously tipped with yellowish-gray; greater secondaries, however, fade into nearly pure white at their tips. The secondaries are white, with the outer web, except at tip, and the median portion of the inner web, dark plumbeous or ashy-gray. Primaries colored almost exactly as in the adults. Rump white, with a tinge of pearl-blue. Tail slightly forked, the emargination being but little more than an inch; inner webs of all the rectrices nearly pure white, but the outer webs are plumbeous-gray, increasing in intensity from within outward; so that the outer pair of rectrices, which are but little tapering or elongated, have their outer webs grayish-black, deepest toward their tips. Entire under plumage, including the under wing-coverts, pure white, with no trace of the plumbeous wash of the adults. The winter range and changes of plumage of this familiar species are not well known; it does not appear to lose the black cap, which nevertheless is imperfect at that season. North America at large, Europe, etc. Breeds and winters variously in its N. A. range. Eggs 3, 1.65 × 1.25, not distinguishable from those of allied species.

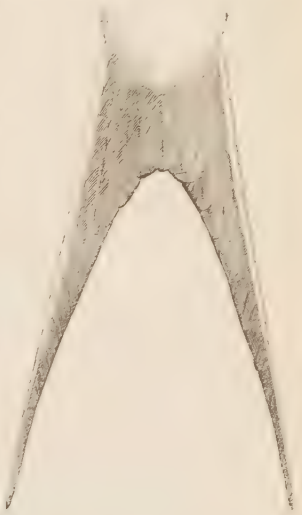


FIG. 516. — Tail of Forster's Tern, about ⅔ nat. size. (From Elliot.)

798. S. forsteri. (To J. R. Forster. Figs. 50, 516.) FORSTER'S TERN. Similar to the last; larger; bill longer, stouter; wings shorter, tail longer; feet longer. Length about 15.00; extent 30.00; wing 9.50–10.50; tail 5.00–8.00, forked 2.50–5.00; bill along culmen 1.50–1.75, averaging 1.60, its depth at base 0.40; tarsus 0.90–1.00; middle toe and claw 1.00–1.10; whole foot averaging 2.00. Adult, spring plumage: Bill orange-yellow, black for nearly its terminal half, the extreme points of both mandibles yellowish; robust, deep at base; culmen declinato-convex, eminence at symphysis well developed; length from $\frac{1}{10}$ to $\frac{2}{10}$ of an inch longer than that of *S. hirundo*. Black pileum not extending so far down on sides of head as in *hirundo*, barely embracing eye (the lower lid of which is white), and leaving a wider white space between the eye and edge of superior maxilla than in *hirundo*. The color of the back hardly differs from that species; perhaps a shade lighter.

Wings comparatively shorter than those of *hirundo*, being absolutely a little shorter, though *forsteri* is a larger bird; very light colored, being strongly silvered; outer web of the first primary is not black, but silvery like the others; all the primaries want the very decided white space on the inner webs which exists in *hirundo* and *macrura;* there are indications of it on the three or four outer primaries, but the others are a nearly uniform dusky gray, moderately hoary. Entire under parts white, with scarcely a trace of the plumbeous so evident in *hirundo*, and so decided a color in *macrura*. Tail a slightly lighter shade of the color of the mantle, separated from the latter for a short space by the decidedly white rump; lateral feathers much more lengthened than in *hirundo*, the elongation generally quite equalling that of *macrura*, and sometimes even exceeding it. These two lateral feathers are white on the *outer* web, dusky-gray on the *inner*. This being exactly the reverse of *hirundo*, and a very noticeable feature, was the first to draw attention to the bird; and this character being so tangible and convenient, writers have perhaps laid too much stress upon it, to the exclusion of others quite as evident. Feet bright orange, tinged with vermilion; tarsus shorter than middle toe and claw; feet longer and stouter by over 0.10 of an inch than the same parts in *hirundo*. Adult, winter plumage: The black of the bill increases so much that nearly the whole bill becomes dusky, except a small space at the base of the under mandible, and a terminal space of varying extent. The feet lose their vermilion tinge and become dusky yellowish. The black pileum more or less variegated with white on forehead; but there is always considerable black left on the nape, and a more or less broad and distinct bar always extends along the sides of the head, embracing the eyes. The lateral tail-feathers have not the elongation and attenuation of those of summer, being but little, if any, longer than those of *hirundo* during the breeding season. The color of the inner web is usually darker, and sometimes extends on the outer as well as the inner, especially toward the tip of the feather. (*S. havelli* Aud.) At the time of the moult the old primaries lose their silvering and become plain brown and white, their shafts being of a decided yellow. The inner webs at this season have white spaces, with nearly as distinctly defined margins as are found in *hirundo* and *macrura*. Young: Bill in all its proportions considerably smaller and weaker than that of the adults; brownish-black, fading into dull flesh-color at base of under mandible. Front white, but the crown and nape show traces of the black that is to appear, which is now mixed with light brown. Pearl-blue of back and wing-coverts interrupted by irregular patches of light grayish-brown, showing a tendency to become transverse bars; this grayish-brown on the tertials deepens into brownish-black, and occupies nearly the whole extent of each feather. The primaries differ from those of the adult in having less silvery gloss, and the inner white spaces more marked, being in fact like those of the adult *hirundo*. Rump and under parts pure white. The tail intensifies, so to speak, its adult characters as regards color; and, independently of any other feature, will always serve to identify the species. It is deeply emarginate, but the lateral feather is not greatly produced, surpassing the second by scarcely more than the latter surpasses the third. Its inner web, for an inch or so from the tip, and both webs of the other feathers, grayish-black; the intensity of this color, and also its extent, decreasing successively on each feather from without inward, so that the central pair scarcely deepen their color at the tips. The outer web of the lateral feather white, but sometimes is just at the tip invaded by the darker color of its inner web. N. Am. at large, common; breeds from Texas to the Fur countries; abundant along Atlantic coast during the migrations; S. in winter to Brazil. Nest in marshes; eggs 2–3, 1.85 × 1.35, yellowish-drab, freely but irregularly spotted and dashed with different shades of brown.

799. S. macru'ra. (Gr. μακρός, *makros*, long; οὐρά, *oura*, tail.) ARCTIC TERN. Adult in breeding plumage: Bill shorter than head, equal to middle toe and tarsus together, slender, compressed, acute, deep carmine, or lake red; usually without any black, but this color sometimes appearing in a limited degree. Feet remarkably small and weak; tibiæ bare for

a moderate distance; tarsi exceedingly short, being less than middle toe without claw, or only equal to it; toes rather long for the size of the feet; the outer falls but little short of the middle one, while the tip of the claw of the inner hardly reaches beyond the third articulation of the middle one. The feet are a lighter tint of the color of bill, tending toward vermilion, or coral-red, but not so light as those of *hirundo*. Wings very long; primaries narrow, tapering to their roundish but slender tips; shafts white, with scarcely darker tips. Outer web of first primary grayish-black, lightening into silvery-gray at tip; inner web white, with only a very narrow line of grayish-dusky along the shaft; this dusky space much narrower and lighter than in *hirundo;* next four or five primaries silvery-gray, darkest toward their tips; their inner webs mostly white (wholly so at their bases); but the white does not extend so far toward the tips of the feathers as on the first primary, and it runs up farther in the centre of the web than on the edge of it. Inner primaries of the color of the back, broadly tipped and margined internally with white. Tail exceedingly long, the exterior feather being as much lengthened, and as narrow, tapering and acute, as in *S. dougalli.* The tail-feathers reach beyond the tips of the folded wings. Tail pure white, the outer web of its exterior feather being grayish-black, lighter basally, and its inner web, and the outer webs of the next two rectrices, having a considerable wash of pearl-blue. Cap pure, lustrous greenish-black, so broad on the cheeks as to leave only a slender line of white to extend along the edge of the feathers on the side of the upper mandible. Upper parts pearl-blue, of about the same shade as in *hirundo;* this color, however, fading into white at tips of tertials and inner secondaries. Under parts but a little lighter shade of the color of the back, fading insensibly into whitish on the chin, throat, and edges of the black cap, and ending abruptly at the under tail-coverts, which are pure white, in marked contrast to the rest of the under parts; lining of wings and axillars also pure white. Winter plumage of adult: Differs from the above chiefly in the color of the cap; forehead white; crown white, but marked with narrow shaft-lines of black, which increase from before backward until, on the nape, the black is nearly or quite pure. A lateral stripe, more or less pure and distinct, extends forward on sides of head over the auriculars, to just in front of eye, leaving, however, the eyelids white. Upper parts much as in summer, but under parts from chin to vent, much lighter. The carmine of bill and feet lighter and duller, but not the coral-red tint of the feet of *hirundo* or *forsteri.* Plumage of the young-of-the-year: Bill much smaller than in the adult, being only 1.08 inches long; brownish-black toward tip; gonys and sides of lower mandible toward the angle of the mouth dull orange; feet only orange-colored on the soles, otherwise brownish-red. Tail much shorter than in adult, only 4.75 to 5.00 inches long, and the outer pair of rectrices broader and scarcely at all tapering in form. Forehead white; the crown streaked with narrow, longitudinal spots of white upon a black ground color, which extends as far as the eyes, and runs back over the temples and auriculars as far as the nape. Whole under parts from the chin, including under tail-coverts and under surfaces of wings, pure white. On the back there predominates everywhere a uniform, light bluish-gray (somewhat darker than in *S. hirundo*), all the feathers tipped with yellowish-white or white, most of them with a blackish-brown streak or crescent-shaped spot near the end; these spots darkest on the tertials and inner secondaries, and aggregated into a single, broad, slate-colored streak on the least wing-coverts. The ashen-blue primaries deepen into slate-color toward their tips; their shafts white, their inner webs with a longitudinal space of white, the outer web of the first slaty-black. Inner tail-feathers white, as are their shafts; their tips white, each with a subterminal crescent-shaped spot of brownish-black. Dimensions of the adult: length (extremely variable from varying length of tail) 14.00–17.00 inches; extent 29.00–33.00; wing 10.00–10.75; tail usually 7.00–8.00, sometimes 6.50–8.50; depth of fork 4.00–5.00; tibiæ bare 0.45; tarsus 0.55–0.65; middle toe and claw 0.80–0.85; inner toe and claw 0.55: whole foot about 1.50; bill along culmen 1.20–1.40; height at base 0.30;

from feathers of side of lower mandible to tip 1.40; gape 1.90; gonys 0.75. A beautiful species, easily recognized by points of size and form, aside from color; this varies much with age and season, giving rise to many nominal species; among American synonyms are *S. pikei* Lawr., *S. longipennis* Coues, *S. portlandica* Ridg. Europe, Asia, Africa; N. Am. at large, northerly; breeds from Massachusetts northward; S. to Middle States and California, and probably farther. Eggs 2-3, not distinguishable from those of the two foregoing species, but averaging smaller.

800. **S. dou'galli.** (To Dr. McDougall. Fig. 511.) ROSEATE TERN. PARADISE TERN. Adult in breeding plumage: Bill about as long as head or foot, straight, slender, compressed, very acute; gonys longer than rami, former straight, latter concave in outline, with acute but not prominent angle between them. Wings shorter than usual, 1st primary little longer than next, all rounded. Tail exceedingly long and deeply forked, with very narrow filamentous outer feathers. Tibiæ slightly denuded; tarsus a little shorter than middle toe and claw. Whole form trim and elegant. Bill black, the extreme point yellowish, the base for a little distance, and inside of mouth, red. Feet bright yellowish-red; claws black. Cap lustrous black, very ample, reaching to lower border of eyes; under eyelid white, as is a streak to end of feathers on bill. Neck all around and entire under parts snowy white, tinted with lovely rose-pink. Mantle delicate pale pearly, over all the upper parts from the neck, including rump and base of tail, fading however to white on tips of tertials and inner webs of secondaries. Long tail-feathers white, with a faint pearly tint. Primaries grayish-black, strongly silvered when fresh; outer web of the first blackish; inner webs of all pure white for more than half their breadth, this white stripe broadest on the first, toward the base of which it occupies the whole web, and on all of them continued to and usually around the very tips; shafts of all the quills white both sides nearly to end. Adult in winter: Bill dull black, with yellowish tip and brown base. Forehead and cheeks white; crown, hind-head, nape, and sides of head, brownish-black, mixed with white on vertex. No rosy tint. Lesser coverts along edge of fore-arm brownish. Tail without much elongation or forking, and pearly like the back. Young, newly fledged: Bill small, weak, slender, greenish-black, hardly 1.10; wings like those of adults. Tail merely forked an inch or so, pearly-blue on outer webs, almost white on inner, with subterminal edging of blackish. General color of upper parts light pearly-blue, variegated on most parts with a delicate mottling of black and buff, the black chiefly in narrow zig-zag cross-bars, broken by the fawn-color; on the wings the variegation in larger pattern, the feathers mostly black with yellowish border. Forehead and cheeks soft light grayish-brown, resolved on crown and hind-head into streaks of blackish and tawny, lost again in blackish on the nape. A silvery-white spot before and above eye; eye surrounded by black. A band of black along edge of forearm, where some of the feathers have yellowish tips. Under parts pure white, a little obscured with gray on the breast. Length of adult 14.00–15.00; extent about 30.00; wing 9.25–9.75; tail 7.00–8.00, forked 3.50–4.50; bill along culmen 1.50; height at base 0.35; length of gonys 1.00, of mandibular rami 0.75; tibiæ bare 0.40; tarsus 0.85; middle toe and claw 1.00. This exquisite species inhabits Europe, etc., and in N. Am. is known to occur along the whole extent of the Atlantic and Gulf States, in various W. I. Islands, and C. Am.; breeds apparently throughout its range, wintering extralimital. Eggs as in other beach species.

801. **S. supercilia'ris antilla'rum.** (Lat. *superciliaris*, relating to the eyebrow, i. e. to the white frontal crescent; *Antillarum*, of the Antilles.) LEAST TERN. Much smaller than any of the foregoing; length about 9.00; extent 20.00; wing 6.60; tail 3.50, forked 1.75; bill along culmen 1.20; depth at base 0.28; tarsus 0.60; middle toe and claw 0.75. Young smaller; length 8.50; wing 6.25; tail 3.00; bill 1.00. Tail moderately forked, the lateral feathers scarcely filamentous, rapidly narrowing to acute tip. Bill about as long as head, rather shorter than whole foot, yellow tipped with black for $\frac{1}{3}$–$\frac{1}{4}$ inch. Cap glossy greenish-

black, with a narrow white frontal crescent the horns of which reach over the eyes, the convexity quite to the bill, but cut off from the white of the cheeks by a line of black through eye to end of feathers on bill. Entire upper parts, including tail, pearly-blue, rather dark and of a leaden shade, reaching quite to the black cap, fading on sides of neck and head into the snowy satiny-white of all the under parts. Tail-feathers like back, but paler basally and white on their under surfaces, and outer web of the outer feather. Mantle extending to very tips of the tertials and secondaries, but inner webs of these feathers nearly white toward the base. Shafts of first two primaries black on top, white underneath, the webs black, the inner with a white space, distinctly outlined from the black, not reaching ends of the feathers; other primaries like back, but darker plumbeous, fading to white on their inner borders. Feet orange-yellow, claws black. Adult in winter: Bill black; feet dull yellowish. Forehead and lores white; crown white, with black shaft-lines; occiput and nape blackish, sending forward a band through eye. Mantle darker than in summer, and more restricted, leaving hind-neck white; a band of grayish-black along fore-arm, and whole edge of the wing of this color. Most of the primaries blackish, without silvering. Young of first winter: Similar, forehead not pure white, nor hind-head quite blackish, mantle varied with lighter tips of most of the feathers; tail with traces of dark spots. Young in August: Bill brownish-black, pale at base below. Forehead mostly white; crown and hind-head varied with white and brownish-black, the latter color especially forming an auricular patch. Pearl-gray mantle of the adults appearing, but interrupted with brown hastate or crescentic spots, one or more on each feather, mottling the whole upper parts. Primaries grayish-black, growing lighter from first to last, margined on inner webs with white, broadly and briefly on outer primaries, more narrowly and lengthily on successive ones; outer web of first primary, and shafts of all on upper side, black. Tail merely emarginate, without elongation of outer feathers; pearly-blue, shading towards the ends of the feathers to dusky-gray, the tips white. Whole under parts pure white. A pretty little "sea-swallow," inhabiting temperate N. Am., especially along the Atlantic coast of the U. S., but also on larger inland waters; Pacific side to California; South into the Antilles and Middle America; very intimately related to the S. Am. *superciliaris* and European *minuta*. Eggs dropped on bare dry sand of beaches, or in a little shelly depression, 1, 2, or 3 in number, 1.20 to 1.30 by 0.99; ground color varying from pale clear greenish to dull pale drab, speckled all over with small splashes, irregular spots and dots of several shades of clear brown, with paler and more lilaceous shell-spots; the markings often evenly distributed, more frequently tending to wreathe at or around the larger end, the point often free from marks or with only a few dots.

802. S. trudeaui. (To Dr. James Trudeau.) TRUDEAU'S TERN. WHITE-HEADED TERN. Size and proportions nearly as in *S. forsteri*, the bill especially of same size and shape. Coloration very different, unique in the subfamily. Adult: Bill straw-yellow at end, apparently bright colored, probably reddish, at base, with a broad black intervening band. The whole head pure white, including all the parts about the base of the bill; this deepens insensibly into the pearly color all around. A narrow distinct bar of slaty-black on side of head, passing through eye from a point just in advance of the auriculars, where the fascia widens and bends down a little. All the rest of the plumage, below as well as above, of a uniform lustrous pale pearly, with the following exceptions: Under surfaces of wings pure white; tail, with its coverts and the rump, white, still with an appreciable pearly tint; tips, and part of inner vanes of secondaries and tertials, white; primaries with the picture common to most terns, with a white space on the inner webs; their darker portions beautifully silvered over with hoary gray, which makes them appear paler than usual; shafts white above and below, except at extreme tips; feet appear to have been reddish or yellowish, certainly of some bright color. Wing 10.25; tail 6.50; depth of the fork 2.75; bill along culmen 1.50; its depth at base 0.38; length of gonys 1.75; tarsus 0.90; middle toe and claw 1.05. A rare and remarkable species belonging to

South America, questionably occurring in N. Am.; "New Jersey and Long Island" (Audubon).

803. S. aleu'tica. (Of the Aleutian Isles. Fig. 517.) ALEUTIAN TERN. Adult: Bill of ordinary shape, as in *hirundo*, *macrura*, etc., entirely black. Feet small, as in the species just named, but the webs more deeply incised; emargination not so great, however, as in *Hydrochelidon*; much as in *Haliplana*. Tibiæ bare to the usual extent. Wings and tail exactly as in *Sterna* proper, the latter, in its length and depth of fork, recalling *macrura* and *forsteri*. Crown and nape black; a large white frontal crescent, the horns of which reach to the posterior border of the eyes, the convexity of which extends into the nasal fossæ, the concavity of which is opposite the anterior border of the eyes; thus broader than in most species similarly marked. The black vertex sends through the eye a band that crosses the cheeks and reaches the bill just posterior to the point of greatest extension of the feathers on the latter. The chin, auriculars, and other parts of the head bordering this vitta below, are pure white, presently deepening insensibly into the hue of the under parts. Tail wholly pure white; no pearly wash on either vane of any of the feathers. Upper parts at large dark pearl-gray, with a dull leaden hue, different from the clear pearly of *macrura*, etc., yet not of the smoky cast of *panayensis*, etc.; it is a tint intermediate between these, that I find difficult to name satisfactorily. The whole under parts, from the white of the chin, just noticed, to the under tail-coverts, paler and more decidedly pearly, more nearly as in full-plumaged *macrura*, yet more grayish. Both under and upper tail-coverts, like the tail, white. The color of the back mounts on the neck behind to the black of the nape without intervention of white. Under wing-coverts and edge of wing pure white; as are all the shafts of the primaries. Primaries blackish lead-color, with silvery hoariness, and each with a large white space on inner web; this white space on the first primary occupies at the base the whole width of the inner web, but grows narrower toward the tip of the feather, ending about an inch from the tip, which is wholly blackish lead-color, this color running down as a narrow margining of the inner vane for two inches or more. On the other primaries successively this white space diminishes in size, and is also less distinctly defined. Secondaries colored much like the back, but the greater part of the inner web of all white, and a narrow oblique touch of white on outer web near its end, which forms a bar across the wing when closed. Bill along culmen 1.40; along gape 1.70; height at base 0.30; length of gonys 0.80; wing 9.75; tail 6.50; depth of fork 2.40; tarsus 0.60; middle toe alone 0.80; its claw nearly 0.30. Alaska and Aleutian Islands; a notable late discovery, coming between the species of *Sterna* proper and the sooty tern group; related to *S. lunata*.

FIG. 517. — Aleutian Tern, much reduced.

FIG. 518. — Foot of Sooty Tern, nat. size. (From Saunders.)

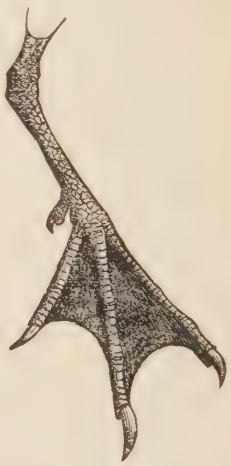


FIG. 519. — Foot of Bridled Tern, nat. size. (From Saunders.)

804. S. fuligino'sa. (Lat. *fuliginosa*, sooty. Fig. 518.) SOOTY TERN. Representing a small group apart from any of the foregoing, named *Haliplana* by some; approaching the noddies slightly. Bill as long as head, scarcely exceeded by whole foot, straight, stout at base, taper-

ing, acute, gonys ascending, commissure not decurved; nostrils rather far forward. Tail deeply forked, as in *Sterna;* feet stout; toes short, with much incised webs. Plumage bicolor. Bill and feet black; iris red. On the forehead a white crescent, reaching over eyes, separated from white of cheeks by a black bridle from eye obliquely downward and forward to bill. Entire upper parts black, deep and uniform, with slight greenish gloss. Entire under parts white, reaching on sides of head to eyes, and more than half-way around neck. Primaries blackish, lighter on inner webs, their shafts brown above, white below; secondaries like primaries, but most of their inner webs whitish; lining of wings white. Tail like back, duller on under surface, the long lateral feathers white, with white shafts, blackening toward end, especially on inner webs. Young entirely different: Bill black above, dull reddish below; eyes and feet dull reddish. Whole plumage smoky-brown, darkest above, paler and grayish or whitish on belly, almost black on primaries, upper wing-coverts and scapulars broadly tipped with white, giving a peculiar spotty appearance; feathers of back, rump, and upper tail-coverts margined with dull rufous. Tail like wings in color, little forked, lateral feathers not elongated. Length about 16.50; extent about 34.00; wing 12.00; tail 7.50, forked 3.00–3.50; bill along culmen 1.80, gape 2.50; depth at base 0.50; tibia bare 0.70; tarsus 1.00; middle toe and claw 1.20; outer do. 1.05; inner do. 0.75; hind do. 0.30. A well-known inhabitant of most of the warmer parts of the globe. In N. Am. N. along Atlantic coast regularly to the Carolinas, casually to New England; breeding so numerously on our S. coast that the eggs are or were an article of commerce. Eggs 3, dropped on the sand, 2.12 × 1.50, buff or creamy, sparingly marked with spots and splashes of light brown and pale purplish.

805. S. anæsthe'tica. (Gr. *ἀναισθητικός, anaisthetikos*, stolid, apathetic. Fig. 519.) BRIDLED TERN. Form of *S. fuliginosa*, but webbing of the toes less extensive, being nearly as deeply incised as in *Hydrochelidon*. Bill and feet black. Crown, and stripe through eye to nostril, black. A white frontal lunula, narrower than in *fuliginosa*, extends some distance behind the eye. The black pileum is, on the nape, sharply defined against ashy-white, which, as it proceeds backward, deepens into cinereous-brown, the prevailing color of the upper parts. Wings, and especially the primaries, darker than the rest of the upper parts, and with scarcely a shade of cinereous; tail, with its coverts, much lighter and more ashy, approaching the nape in color. The primaries have well-defined, pure white spaces running for a considerable distance from their bases along the inner web, while in *fuliginosa* the inner webs are simply grayish-brown, with no well-marked pictura. A large part of inner webs of secondaries and tertials white. All the under wing-coverts pure white. Central tail-feathers brownish-ashy, concolor with their coverts. The lateral ones have much white toward their bases, especially on the inner webs, and this increases on each feather successively to such an extent that the next to the outer one is wholly white except a small space at its tip, while the outermost is entirely white. Shafts of primaries brownish-black above, white beneath; of the rectrices, dark along the cinereous, and white along other portions of the feathers. Below, the bird is entirely pure white. Dimensions: length 14.00 to 15.00 inches; wing 10.50; tail 6.00 to 7.00; bill 1.04 to 1.60; height at base 0.35 to 0.40; width slightly less; tarsus 0.85; middle toe the same, with the claw 1.20; outer toe and claw 1.00; inner 0.75. Immature plumage: Black of pileum imperfect, largely mixed with white on the vertex, so that it fades insensibly into the white of the lunula, which latter is thus obscured. The black bridle is correspondingly imperfect. Upper parts paler and grayer, some of the feathers being margined with whitish. Lateral rectrices not wholly white. Under parts pure white, as before. This is probably not the youngest plumage (of which I have yet to see specimens; described as being light-colored below from the very first), but rather represents a plumage that closely resembles, if it be not identical with, the ordinary winter plumage of the adult. This perfectly distinct species inhabits warmer parts of the globe in both hemispheres; West Indies and Florida. (*Haliplana discolor*, Coues.)

315. HYDROCHELI'DON. (Gr. *ὕδωρ, hudor*, water; *χελιδών, chelidon*, a swallow.) BLACK TERNS. Bill a little shorter than head, longer than middle toe and claw; very delicate, slender, acute; culmen and commissure decidedly declinato-convex, the amount of curvature increasing toward the tip; outline of rami and gonys both concave, the former most so; eminentia symphysis prominent and very acute. Wings exceedingly long, pointed, of same color as back, without distinct markings on either web. Primaries broad and not very tapering, not acute; tertials very short, rounded, not slender nor flowing, reaching in the folded wing only half-way to tip of longest primary. Tail rather short, contained 2½ times in the wing, only moderately emarginate (much as in *Gelochelidon*), the lateral feathers but little exceeding the next, not tapering and acuminate; all the feathers broad and rounded. Feet slender and short; tarsi much abbreviated, rather less than the middle toe alone. Toes moderately long; the webs rather narrow and very deeply incised (fig. 51). Size small, general form delicate; colors mostly black, the wings and tail plumbeous.

Analysis of Species.

Wings and tail above like back . . . . . *lariformis* 806
Wings whitening along border of forearm; upper tail-coverts white . . . . . *leucoptera* 807

806. H. larifor'mis. (Lat. *lariformis*, gull-shaped.) BLACK TERN. SHORT-TAILED TERN. Adult, in summer: Head and neck all around and under parts to the vent, jet black; under tail-coverts pure white. On back of neck, and between shoulders, the black lightening into leaden-gray, which extends over all the upper parts to the very tips of the tail-feathers. Tertials like back; secondaries darker, tending to the color of the primaries, which are grayish-black, silvered, with paler margins of inner webs, their shafts white except at tips. Lining of wings ashy-white, reaching a little over border on to lesser coverts. Bill and claws black, angle of mouth lake red; feet reddish-brown; eyes brown. In winter: Very different; forehead, sides of head, neck all round, and entire under parts, white; under wing-coverts only ashy-gray. Upper parts generally as in summer, but paler, many feathers with whitish edges. A grayish-black bar along lesser coverts. On the crown, white varied with grayish or ashy, darker on nape, with bar through eye. While changing, head and under parts patched with white and black. Young: Bill brownish-black, base below flesh-color; mouth yellow; feet light brown. Forehead grayish-white, deepening on crown and nape to grayish-brown which reaches down to the back, obscuring the plumbeous; interscapulars quite brown; on other upper parts the brown edges the feathers. Lesser wing-coverts grayish-black. A black crescent before eye. Under parts pure white, the sides of the breast ashy-brown, the sides of the body and lining of the wings ashy. Quills as in the adults, but the shafts of the primaries brown. Length about 9.25; extent 25.00; wing 8.25; tail 3.75, forked 1.00; bill along culmen 1.10; along gape 1.60; height at base 0.25; gonys 0.60. Young smaller, about 8.00; bill 1.00; tail shorter and less forked. N. Am. at large, interior and coastwise, abundant. Breeds in large colonies anywhere, in marshes and reedy sloughs, in June. Eggs on débris of dead reeds, often wet and floating, without any nest; 2–3, 1.35 × 0.95 average, pointed, yet with considerable bulge of the sides; ground color brownish-olive, rather pale and clear, thickly marked with spots and splashes of every size from dots to masses, but mostly large and bold, of light brown and blackish-brown, and the usual neutral-tint shell-markings; tendency to aggregate at or around the larger end.

807. H. leuco'ptera. (Gr. *λευκός, leukos*, white; *πτέρον, pteron*, wing.) WHITE-WINGED BLACK TERN. Adult in summer: Bill black, tinged with red; feet red; claws black. Head and neck all around and under parts pure black, shading on back and scapulars into dark slaty plumbeous; wings dark silvery-plumbeous, fading to white along border of forearm, the quills silvered-dusky with white shafts and dull white area on inner webs of the primaries; lining of wings sooty blackish, varied with white along the border. Tail and its coverts, above and

below, white, abruptly contrasting with dark slate of the rump and black of the belly, the tail-feathers shaded with pearly-gray toward their ends. Length (of skin) 8.00; wing 7.50; tail 2.75, forked under 0.50; bill along culmen 0.90, along gape 1.20, height at base 0.20; tarsus 0.75; middle toe and claw 0.87. Resembling the last, and changes of plumage correspondent; distinguished in any plumage by white upper tail-coverts and lesser wing-coverts. Europe; accidental in N. A. in one instance (Wisconsin).

316. **ANOÜS.** (Gr. *ἄνους, anous*, mindless, regardless; i. e. stupid.) NODDIES. Bill about as long as head or longer, much longer than tarsus, moderately robust or very slender, depressed, as broad as high at base; elsewhere depressed, tapering to an acuminate and somewhat decurved tip. Fore end of nostrils nearly half-way to end of bill, the fossæ long and deep. No frontal antiæ; outline of feathers on base of bill convex (reverse of *Sterna*). Wings but moderately long for this subfamily, the second primary but little shorter than the first. Tail very long, broad, *fan-shaped, double-rounded*, i. e., graduated laterally, yet with central feathers shorter than the next. Tarsi very short, robust, less than the middle toe without its claw. Lateral toes, especially the inner, unusually lengthened; hallux well developed. Webs broad and full, not incised. Claws short, stout, little curved, but very acute. Podotheca nearly smooth, from tendency to fusion of the plates, there being but a single defined row of scutella in front, with delicate reticulations elsewhere; soles of the webs perfectly smooth. Edges of middle claw dilated and somewhat pectinate. Plumage dark or nearly unicolor. A remarkable genus. There are several species of warmer parts of the world, all alike sooty-brown, with hoary or whitish head. They alight with ease on trees and bushes, where the nest is usually placed.

808. **A. sto'lidus.** (Lat. *stolidus*, stolid, stupid.) NODDY TERN. Adult, breeding plumage: Both mandibles marked with more or less distinct longitudinal striæ; their tomia inflected. Nasal sulcus deep and long, formed by the rounded culmen and a prominent ridge, which runs along the upper mandible from its base to beyond the nostrils, where it is gradually lost. Just above the base there is a small but distinct fossa, separated by an oblique ridge from the large nasal sulcus. Culmen about straight for half its length, regularly decurved toward the tip, basally broad and flat. Commissure slightly declinato-convex. Outline both of rami and gonys concave, the former most so; eminentia symphysis illy defined and not acute. Primaries unicolor, very broad almost to their tips, which are rounded; first primary scarcely surpassing the second. Tail very long and much graduated; but there is also a slight emargination, the two central rectrices being a little shorter than the next pair. Bill and claws black. Mouth black to a little beyond the angle of the jaws, the fauces yellowish. Eyes brown. Tarsi and toes dark reddish-brown, nearly black in the dried skin. Occiput bluish-plumbeous, becoming pure white on the front. Sides of the head and neck all round with a decided wash of bluish-plumbeous. The whole body is a deep fuliginous brown, growing almost black on the remiges and rectrices, with a very dark spot anterior to and just above the eye. Dimensions: length 16 inches; extent of wings 31.00; wing from flexure 10.00 to 11.00; tail about 6.00; bill along culmen 1.75; height or width at base 0.38; tarsus 1.00; middle toe and claw 1.45; outer ditto but slightly shorter; inner ditto 1.20; hallux 0.40; breadth of webs 0.90; diameter of eye 0.30. Widely distributed over warmer parts of the globe; in N. Am., S. Atlantic and Gulf States, breeding by thousands on the low mangrove and other bushes, where the bulky nest of sticks is placed. Eggs 3, about 2.00 × 1.35, warm buff, spotted and splashed with reddish-brown and neutral tints.

73. Subfamily RHYNCHOPINÆ: Skimmers.

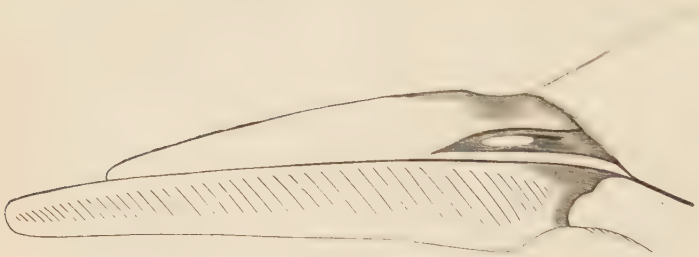


Fig. 520. — Bill of Skimmer, nat. size.

Bill hypognathous. Among the singular bills of birds that frequently excite our wonder, that of the skimmers is one of the most anomalous. The under mandible is much longer than the upper, compressed like a knife-blade; its end is obtuse; its sides come abruptly together and are completely soldered; the upper edge is as sharp as the under, and fits a groove in the upper mandible; the jawbone, viewed apart, looks like a short-handled pitchfork. The upper mandible is also compressed, but less so, nor is it so obtuse at the end; its substance is nearly hollow, with light cancellated structure, much as in a toucan; it is freely movable by means of an elastic hinge at the forehead. There are cranial peculiarities. Conformably with the shape of the mouth, the tongue differs from that of other *Longipennes* in being very short and stumpy, as in kingfishers, and the *Steganopodes*. The wings are exceedingly long, and the flight more measured and sweeping than that of terns; the birds fly in close flocks moving simultaneously, rather than in straggling companies. They seem to feed as they skim low over water, with the fore parts inclined downward, the under mandible probably grazing or cutting the surface; but they are also said to use their odd bill to pry open weak bivalve mollusks. The voice is very hoarse and raucous, rather than strident. They are somewhat nocturnal or at least crepuscular; their general economy is the same as that of terns, as are all points of structure excepting those above specified. Besides the following, there are only two species: *R. flavirostris* and *R. albicollis*, of Asia.

317. RHYN'CHOPS. (Gr. ῥύγχος, *hrugchos*, beak; ὤψ, *ops*, the face; well applied to the bird whose beak is such an extraordinary feature.) Skimmers. Character as above.

809. R. ni'gra. (Lat. *nigra*, black. Fig. 520.) Black Skimmer. Adult ♂ ♀: Bill with basal half carmine-red, rest black. Iris hazel. Feet carmine-red, drying yellowish, with black claws. Crown of head, its sides to just below eyes, back of neck and whole upper parts, glossy jet-black. Forehead, sides of head below eyes, sides of neck and whole under parts, pure white, tinted rosy or creamy in the nuptial season. Lining of wings and the bordering under wing-coverts, black. Primaries black, with black shafts, their inner webs duller blackish, the inner four with inner webs and tips of both webs, white; secondaries white, with a space of dark color on outer and small part of inner webs, increasing in amount inwards, till the inner four are dark with only white tips. Tail-feathers white, the inner webs more or less obscured with dark brown. Length 16.00–20.00; extent 42.00–50.00; wing 13.00–16.50; tail 4.00–6.00, forked about 1.50; tibiæ bare 1.00; tarsus 1.45; middle toe and claw 1.30. Length of under mandible 3.50–4.50, of upper about 3.00; height opposite nostrils 0.65; width 0.45; gape 4.50 or more; fused tomia or gonys of under mandible 4.00 or less; greatest depth of under mandible 0.60. ♀ smaller than ♂. Young at minimum dimensions given. Young-of-the-year: Bill smaller than in adult, thinner, weaker, its ridges less sharply defined, and the two mandibles of less unequal lengths. Bill brownish-black for three-fourths of its length, fading into dull horn-color just at its tip, lightening into more or less intense flesh-color, or light reddish, toward the base. The striæ on the sides of the lower mandible are as numerous as, but much less distinct than, in the adult. Tail

shorter and less deeply emarginate. Legs and feet dull light reddish. Entire upper parts a rather light grayish-brown, deepest on the wing-coverts and tertials; each feather with a tolerably broad margin and tip of white, broadest and most conspicuous on the wing-coverts and tertials. Forehead, sides of the head below the eyes, the neck all round, the edge of the fore-arm, inferior surfaces of the wings, and whole under parts, white. Primaries almost exactly as in the adults, except that the innermost have more white, and there is a slight white terminal margin as far as the fourth or fifth. Secondaries about as in the adults, but their brown portions lighter and duller. Tail white; the greater part of the two central rectrices, and the inner webs of the others, with a tinge of dull grayish-brown, deepest on the middle pair. S. Atlantic and Gulf States, strictly maritime, abundant; casually N. to New England. Nesting like that of terns, in communities; eggs dropped on the sand, 3 in number, pure white, spotted and splashed with dark browns and blackish, and pale neutral-tint.

20. Suborder TUBINARES: Tube-nosed Longwings.

Character and definition of this group the same as of the single

60. Family PROCELLARIIDÆ: Petrels.

Fig. 521. — Nest of the Fulmar. (Designed by H. W. Elliot.)

Nostrils tubular. Bill epignathous; its covering discontinuous, consisting of several horny pieces separated by deep grooves. Hallux small, elevated, functionless, appearing merely as a sessile claw, often minute, or absent.

These are oceanic birds, rarely landing except to breed, unsurpassed in powers of flight, and usually strong swimmers. Excepting the Sea-runners (*Halodrominæ*), none of them dive. With the same exception, the wings are long, strong, and pointed, of 10 stiff primaries and numerous short secondaries; the humeral and antibrachial portions are sometimes extremely lengthened. The tail is short or moderate, of less than 20 feathers, variable in shape. The feet are usually short, with long full-webbed front toes, and a rudimentary hallux, or none. In size, these birds vary remarkably, ranging from

that of a swallow up to the immense albatrosses, probably unsurpassed by any birds whatever in alar expanse, and yielding to few in bulk of body. The plumage is compact and oily, to resist water; the sexes appear to be always alike, and no seasonal changes are determined; but some variation with age, or as a matter of individual peculiarity, certainly occurs in many cases. The food is entirely of an animal nature, and fatty substances, in particular, are eagerly devoured. When irritated, many species eject an oily fluid from the mouth or nostrils, and some are so fat as to be occasionally used for lamps, a wick being run through the body. The eggs are few, or only one, laid in a rude nest or none, on the ground or in a burrow. Petrels are silent birds, as a rule, contrasting with gulls and terns in this particular; many or most are gregarious, congregating by thousands at their breeding places or where food is plenty.

Birds of this family abound on all seas; but the group is yet imperfectly known. Bonaparte gave 69 species, in 1856; my memoirs upon the subject (1864–66) present 92, of which 17 are marked as doubtful or obscure; in 1871 Gray recorded 112; there are probably about 75 good species. They are sharply divided by the character of the nostrils into three groups; two represented in North America, as beyond, and the *Halodrominæ*. These last, consisting of one genus and three species or varieties, are remarkably distinguished from the rest, resembling Auks in external appearance and habits; the wings and tail are very short; there is no hind toe; the skin of the throat is naked and distensible; the tubular nostrils, in fact, are the principal if not the only outward petrel-mark, and these organs are unique in opening directly upward, the nasal tube being vertical instead of horizontal as in all the rest.

74. Subfamily DIOMEDEINÆ: Albatrosses.

Fig. 522. — Bill and Foot of Short-tailed Albatross. (After Cassin.)

Nostrils disconnected, placed one on each side of the bill near the base. Hallux rudimentary, so small as to be usually called wanting. Of largest size in this family. There are eight unquestionable species, with two or three doubtful or obscure ones. Only three have proven their right to a place here. There is no well authenticated instance of the occurrence of the great Wandering Albatross, *D. exulans*, off our coasts; but it has been taken in Europe, and is liable to appear at any time. It is distinguished from the first species following by its great size, and the outline of the frontal feathers; deeply concave on the culmen, strongly convex on the sides of the bill to a point nearly opposite the nostrils. The Yellow-nosed Albatross, *D. chlororhyncha* (of Audubon, not of Gmelin), is the *D. culminata*, a species of Australian and other Southern seas, *said* to have been taken "not far from the Columbia river," but there is no reason, as yet, to believe it ever comes within a thousand miles of this country. It has the bill black, with the culmen and under edge yellow. Other well-known species of Southern seas are *D. chlororhyncha*, *cauta*, and *melanophrys*.

Analysis of Genera.

Tail rounded, contained 3 or about 3 times in length of wing. Bill stout, evenly encircled by feathers at base . . . . . *Diomedea* 318

Tail cuneate, contained about twice in length of wing. Bill compressed, with frontal reëntrance and lateral salience of feathers at base . . . . . *Phœbetria* 319

318. **DIOMEDE'A.** (Gr. Διομήδης. *Diomedes*, a Grecian hero, Jove-counselled.) Albatrosses. Bill thick, stout, and heavy, especially broad at base, without colored groove along lower mandible, or other special parti-coloration. Nasal tubes ample. Tail short, rounded, less

than half the wing (in one species about one-third the wing). Coloration variegated with white and black, or uniformly fuliginous. Of largest size in the subfamily. *D. exulans* is type of this group; our two species fall in a subgenus *Phœbastria*.

Analysis of Species.

Adult white, with dark wings and tail; bill and feet light . . . . . *brachyura* 810
Adult fuliginous; bill and feet dark . . . . . *nigripes* 811

810. D. brachyu'ra. (Gr. βραχύς, *brachus*, short; οὐρά, *oura*, tail.) SHORT-TAILED ALBATROSS. Bill 5.00 or 6.00 inches long, with moderately concave culmen and prominent hook. Frontal feathers forming almost no reëntrance on culmen, running nearly straight around whole base of upper mandible, and extending scarcely farther on sides of under mandible, with hardly any convexity. Tail very short, contained rather more than 3 times in length of wing. Total length about 3.00 feet, with spread of about 7.00 feet; wing 20.00 inches; tail 5.50–6.00 inches; tarsus nearly 4.00 inches. Adult plumage white, the head and neck usually washed with shining rusty-yellow; wings and tail dark or blackish, with a wholly indeterminate amount of white on the coverts and inner quills — sometimes nearly all the wing-coverts white excepting a line along the border of the fore-arm — sometimes the white restricted to a small space at the elbow. Bill pale reddish-yellow, drying pale dingy-yellowish; feet flesh-color. Young dark-colored, resembling *nigripes*, but easily distinguished. Pacific Ocean at large; abundant off our coast. This albatross drops a single egg on the ground, nearly equal-ended, white, 4.20 × 2.60; both sexes incubate.

811. D. ni'gripes. (Lat. *nigripes*, black-footed.) BLACK-FOOTED ALBATROSS. Bill about 4.00 (never 5.00) inches long, extremely stout, with the culmen almost perfectly straight to the hook, which is comparatively small and weak, scarcely rising above level of the culmen. The horny piece forming the culmen very broad, especially at base, where it widens and descends to overlap the lateral piece. Outline of feathers much as in *brachyura*, yet a slight reëntrance on forehead, and feathers on sides of under mandible salient with a slight convexity. Commissure about straight to the hook. Bill about one-third longer than head, slightly longer than tarsus, equal to middle toe without claw; 1.50 deep and 1.25 wide at base. Tail contained 3 times in the wing. Bill dark-colored; feet black. Plumage dark chocolate-brown, paler and grayer, rather plumbeous, below, lightening or whitening on head; feathers of the upper parts with paler edges, as if faded; spot before eye and streak over eye quite black. Primaries black, duller on inner webs, with yellow shafts to near the end; tail blackish, duller below, with whitish shafts except at tip. A final plumage may be lighter than as described, but is never white, and other characters prove the validity of the species. Chord of culmen 4.00, its curve 4.60; distance from feathers on side of upper mandible to tip 3.50; ditto lower mandible 3.20;

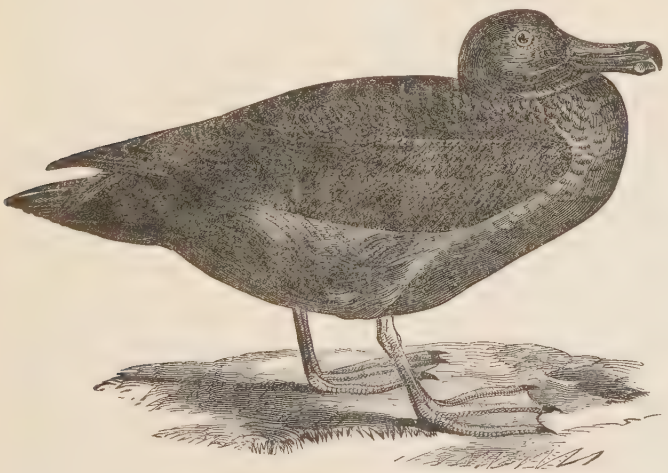


FIG. 523.—Sooty Albatross, much reduced. (From Tenney, after Audubon.)

tarsus 3.70; middle or outer toe and claw 4.50; inner do. 4.00. Wing 19.00–20.00; tail about 6.50. Pacific coast of N. Am., abundant.

319. PHŒBE'TRIA. (Gr. φοιβήτρια, *phoibetria*, a soothsayer, presager.) BLACK ALBATROSS. Bill comparatively slender, strongly compressed, with sharp culmen; side of under mandible with a long colored groove. Frontal feathers forming a deep acute reëntrance on culmen; a long acute salience on side of lower mandible. Nostrils low and strict. Tail cuneate, contained twice in the length of wing. Plumage uniformly dark. One species.

812. P. fuligino'sa. (Lat. *fuliginosa*, sooty. Fig. 523.) SOOTY ALBATROSS. Bill with shape and outline of feathers as above said; chord of culmen 4.00–4.50; height of bill at base 1.50, at hook 1.00; width at base 0.75; from feathers on side of upper mandible to tip 3.50, ditto lower mandible 2.50. Wing 20.00–22.00; tail 10.00–11.00, graduated 3.50–4.50; tarsus about 3.00; middle toe and claw 4.75, outer do. 4.50, inner do. 4.00. Plumage ordinarily uniform sooty-brown; quills and tail blackish with white shafts; eyelids white; bill black, with long yellow (perhaps in life pink or red) groove; feet pale or flesh-color, drying yellow. In some cases the plumage lightens to a clearer more ashy-gray coloration on various parts. The head and neck frequently washed with rusty-yellow. Pacific ocean at large; off coast of N. Am.

75. Subfamily PROCELLARIINÆ: Petrels.

Nostrils united in one double-barrelled tube laid horizontally on the culmen at base. Hallux present, though it may be minute. Five groups of petrels may be distinguished, although they grade into each other; four of them are abundantly represented on our coasts. The *fulmars* are large gull-like species (one of them might be taken for a gull were it not for the nostrils), usually white with a darker mantle, the tail large, well formed (of 14–16 feathers), the nasal case prominent, with a thin partition. They shade into the group of which the genus *Œstrelata* is typical, embracing a large number of medium-sized species, chiefly of Southern seas, in which the bill is short, stout, very strongly hooked, with prominent nasal case; the tail rather long, usually graduated. The *shearwaters* (*Puffinus*) have the bill longer than usual, comparatively slender, with short low nasal case, obliquely truncate at the end, and the partition between the nostrils thick; the tail short and rounded; the wings extremely long; the feet large. The elegant little "Mother Carey's chickens" or "stormy petrels" ("*Thalassidroma*" of authors; *Procellaria* proper and its relatives) are a fourth group, marked by their small size, slight build, and other characters; their flight is peculiarly airy and flickering, more like that of a butterfly than of ordinary birds; they are almost always seen on wing, appear to swim little if any, and some, if not all, breed in holes in the ground, apparently like bank swallows. Like other petrels they gather in troops about vessels at sea, often following their course for many miles, to pick up the refuse of the cook's galley. Some of them, as the species of *Oceanites*, have remarkably long legs, with fused scutella, flat obtuse claws, and the hallux exceedingly minute; in the rest, the feet are of an ordinary character. The exotic genus *Prion* typifies a fifth group, of five or six species; here the bill is expanded, and furnished with strong laminæ, like a duck's; the colors are bluish and white.

Analysis of Genera.

Fulmars, with prominent nasal tube, vertically truncate and with thin partition; under mandible not hooked at end. Length 16.00 or more.
- Tail 16-feathered. Length about 3 feet . . . . . *Ossifraga* 320
- Tail 14-feathered. Length 15–20 inches.
  - Bill very stout, much shorter than tarsus . . . . . *Fulmarus* 321
  - Bill slenderer, little shorter than tarsus . . . . . *Priocella* 322

Petrels, with nasal tubes as before, the bill very stout and strongly hooked. Length 10.00 to 16.00.
- Plumage spotted above, white below . . . . . *Daptium* 323
- Plumage uniformly dark above, and white below; or, entirely fuliginous . . . . . *Œstrelata* 324

Stormy Petrels, with nasal tube as before, the bill variable. Length under 10.00.
- Claws hooked, acute; tarsus little if any longer than middle toe and claw.
  - Tail cuneate. Color uniform fuliginous . . . . . *Halocyptena* 325
  - Tail nearly square. Color fuliginous, with white . . . . . *Procellaria* 326
  - Tail forked. Color fuliginous, or dark with white . . . . . *Cymochorea* 327
  - Tail forked. Color bluish or grayish, with white . . . . . *Oceanodroma* 328
- Claws flat, obtuse; tarsus much longer than middle toe and claw.
  - Color fuliginous; upper tail-coverts white; webs yellow . . . . . *Oceanites* 329
  - Color dark, the underparts white; webs black . . . . . *Fregetta* 330

Shearwaters, with low broad nasal case, and end of under mandible hooked like the upper. Length 12.00 or more.
- Nasal tube truncate, with the partition thin, as in fulmars . . . . . *Priofinus* 331
- Nasal tube obliquely truncate, the partition thick . . . . . *Puffinus* 332

320. **OSSI'FRAGA.** (Lat. *ossifraga*, bone-breaking; *os* and *frango*.) GIANT FULMAR. Of immense size and powerful organization; as large as most of the albatrosses. Bill longer than head, about as long as tarsus, very robust, deeply grooved; nasal tube very long, depressed, carinate, with contracted orifice; reaching half way or more from base to tip of bill. Hook of bill large and strong. Commissure sinuate; gape restricted, not reaching under eye. Frontal feathers extending obtusely upon root of nasal case; mental feathers extending to gonys. Outline of lower mandibular rami about straight; gonys straight, ascending, with obtuse angle. Feet large; tibiæ bare below; tarsus short, much less than middle toe without claw, reticulate; outer and middle toes with claws of equal lengths; hind toe merely a stout claw; webs full. Wings short, not very acute, folding short of end of tail. Tail moderate, graduated, 16-feathered. One species.

813. **O. gigan'tea.** (Lat. *gigantea*, gigantic.) GIANT FULMAR. BONE-BREAKER. The largest of the petrels, equalling most of the albatrosses in size. Length about 3.00 feet; spread 7.00 feet; wing 20.00 inches; tail 8.00; bill 3.50–4.00, the nasal case nearly 2.00; tarsus 3.50; middle or outer toe and claw nearly 6.00; inner do. 4.50. Plumage very variable with age or other circumstances; usually dark dingy gray, or uniform fuliginous above, paler, whitish or white below; wings and tail uniform dusky; bill mostly yellow (dried); feet dingy yellowish or brownish-black. Pacific Ocean; "common off Monterey."

321. **FUL'MARUS.** (Latinized from Eng. *fulmar*.) FULMARS. Of moderate size, and general gull-like aspect; white with pearly-blue mantle. Bill shorter than tarsus, about two-thirds as long as head, very robust, especially at base, with turgid sides; hook short, stout, very convex, rising almost from the end of the nasal case; commissure greatly curved; outline of mandibular rami a little concave; gonys ascending; grooves of both mandibles profound. Nasal tube long, nearly half the culmen, prominent, turgid, with straight upper outline, truncate emarginate end and thin partition. Wings of moderate length, folding about to end of tail; primaries broad, tapering rapidly to rounded ends, 2d nearly as long as 1st. Tail of 14 feathers broad to their ends, somewhat graduated. Feet rather small, gull-like; tibiæ bare below; tarsus compressed, three-fourths as long as middle toe and claw. Outer and middle toes with claws of about equal lengths; hind toe appearing as a stout sessile claw. One species, of several varieties.

814. **F. glacia'lis.** (Lat. *glacialis*, icy.) FULMAR. Length 15.00–20.00 inches, averaging 16.50; wing 11.00–13.00; tail 4.00 or 5.00; chord of culmen 1.50 (1.30–1.80); bill about 0.75 deep at base, and nearly as wide; nasal tube 0.60 long; tarsus 2.00 (average); middle toe without claw 2.25. Adult ♂ ♀: White; mantle pale pearly-blue, restricted to back and wings, or extending on head and tail; usually a dark spot in front of eye; quills dark ashy-brown. Bill yellow, tinged with sea-green on culmen and lower mandible, the opening of the nostrils black; feet drying dingy yellowish, said to be delicate French gray in life; iris brown. Young: Smoky-gray, paler below, the feathers of the upper parts with darker margins; primaries as in the adult; colors of bill and feet obscured. Extraordinarily abundant in the N.

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Atlantic, swarming at some of its favorite breeding places, especially St. Kilda, wide ranging at other seasons; S. to U. S. in winter. Nest on crags over the sea; egg single, white, with rough brittle shell, resembling a hen's egg in size and shape; young covered with whitish down; fed in the nest by regurgitation of an oily fluid. The fulmars are very greedy of fatty substances, and constantly attend the whale-fishery to feed upon the blubber.

815. **F. g. paci'ficus.** (Lat. *pacificus*, pacific.) PACIFIC FULMAR. Averaging darker than No. 814, the mantle bluish-cinereous rather than pale pearly-blue; the bill rather weaker and less strongly hooked. N. Pacific, in vast numbers. Changes of plumage, habits, etc., the same as those of the common species.

816. **F. g. rod'gersi.** (To Comm. John Rodgers, U. S. N.) RODGERS' FULMAR. The mantle dark, as in *pacificus*, but much restricted, most of the wing-coverts and inner quills being white; primaries mostly white on inner webs, their shafts yellow. Size and shape as before. N. Pacific, swarming on some of the rocky islands in Behring's sea. Nest on the crags; single egg white, nearly equal-ended, rough with innumerable pits and points, 2.90 × 1.90; chick hatches like a puff-ball of white down.

322. **PRIOCEL'LA.** (*Prion* + *Procella*.) GULL FULMARS. Character of *Fulmarus* proper; bill little shorter than head or tarsus, about $\frac{3}{5}$ the middle toe and claw, compressed, higher than broad at base, not very robust, sides regularly tapering to rather narrow tip; grooves not so well marked as usual; hook moderate; commissure a little curved; outlines of inferior mandibular rami and gonys both slightly concave; nasal tube $\frac{1}{3}$–$\frac{2}{5}$ the culmen, depressed at base, high and narrow at end. Feet, wings, and tail as in *Fulmarus*. Two species; ours curiously resembling a gull.

817. **P. tenuiros'tris.** (Lat. *tenuirostris*, slender-billed. Fig. 524.) SLENDER-BILLED FULMAR. Adult ♂ ♀ : Plumage white, with clear pearly-blue mantle, and black primaries, just like a

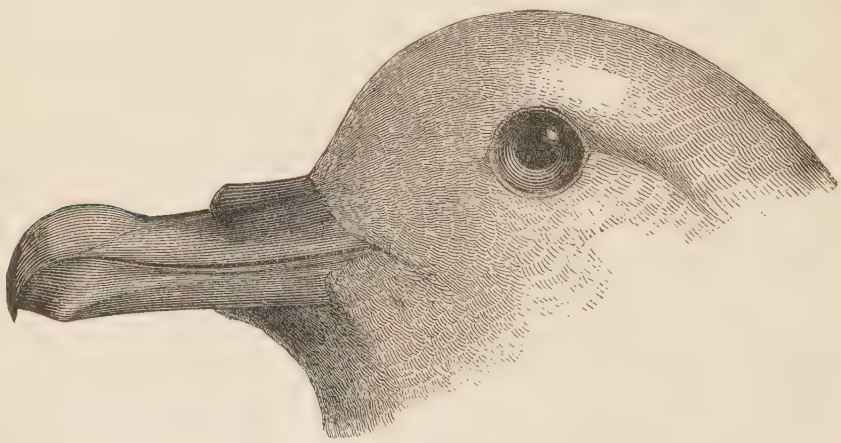

FIG. 524. — Slender-billed Fulmar, nat. size. (From Elliot.)

gull; the mantle beginning faintly on the nape, continuing over whole back, rump, tail, wing-coverts and inner quills; edge of the wing slaty-gray; primaries black, their shafts yellowish-white at base, their inner webs pearly-white to near the ends; white of first primary extending to within two inches of the tip, further on the rest successively, reaching the end on the 6th; outer webs of secondaries slaty-black, inner white; a small dusky spot before eye; a faint pearly shade on sides of breast and body. Bill and feet (dry) yellow; nasal tube and hook obscured with bluish horn-color. Length about 18.50; extent about 36.00; wing 13.00; tail 5.25; tarsus 2.00; middle toe and claw 2.60; outer do. 2.70; inner do. 2.25; chord of

culmen 2.00; height or width of bill at base 0.75; nasal tube 0.67; the bill is really very stout, only "slender" in comparison with the short robust organ of the common fulmar. Young not seen; changes of plumage probably coincident with those of *Fulmarus*. A species described under a large and not select assortment of names, both generic and specific, but easy to identify; wide ranging over much of the water of the world; occurs on the Pacific coast of N. Am., as at Kotzebue Sound.

323. **DAP'TIUM.** (Gr. *δάπτω, dapto,* I devour.) PIGEON PETREL. Bill much shorter than head or tarsus, very stout and especially wide, as broad as high as far as the hook, where abruptly compressed; culmen nearly straight from tube to hook, which latter is neither large nor much decurved; sides of bill turgid, with convex outline from base to hook; forks of lower mandible wide apart, enclosing a flat-iron shaped space; rictus ample; skin of throat loose and distensible, partly naked; gonys very short, with slight angle; inside the edge of the upper mandible a series of oblique ridges; nasal case ⅓ as long as culmen, broad, depressed, with circular truncate orifice. (Chars. of bill approaching those of *Prion*.) Wings folding about to end of the short rounded tail, which is contained 2½ times in length of wing. Tibiæ little bare below; tarsus much shorter than middle toe and claw, stout, compressed, reticulate with small circular plates outside, large inside; outer toe without claw longer than middle toe alone; hind toe well developed for this family. Small; plumage spotted. One species.

818. **D. capen'se.** (Of the Cape of Good Hope.) PINTADO PETREL. CAPE PIGEON. DAMIER. Spotted above with blackish and white; white below; tail black-barred; bill black. Length 15.00; wing 11.00; tail 4.50; bill 1.33; tarsus 1.67. Southern Seas at large; accidental on coast of California and of Maine. (See especially N. Eng. Bird-Life, ii, 1883, p. 386.)

324. **ŒSTRE'LATA.** (Gr. *οἰστρήλατος, oistrelatos,* goaded on by a gad-fly.) GADFLY PETRELS. DIABOLIC PETRELS. Bill about as long as tarsus, stout, compressed throughout, with nearly straight converging lateral outlines, the hook particularly large, high-arched, long-decurved, rising almost immediately from the end of the nasal tube, leaving but a short concave culmen proper. Lateral horny piece of the bill very large, turgid, rising high at root of nasal case, convex along under outline; commissure strongly sinuate throughout; outline of mandibular rami nearly straight, of gonys a little concave, the tip of the under mandible being curved down to fit the arch of the hook. Grooves of both mandibles distinct. Nasal case of moderate length, high, not carinate, about straight, truncate at end, with thin partition between the tubes coming well forward. Interramal space narrow, fully feathered. Wings pointed, very long, folding beyond end of tail. Tail long, with graduated feathers, wedge-shaped or much rounded. Feet of moderate size; tarsus reticulate, about as long as, or little shorter than, middle toe without claw; outer toe alone rather longer than middle; with its claw, about as long as middle toe and claw; tip of inner claw reaching base of middle. Hallux a short sessile claw. A genus of numerous (about 20) medium-sized and rather small species, inhabiting the southern seas; some bicolor, others uniform fuliginous. Our four are mere stragglers to N. Am., unless *Œ. fisheri* should prove otherwise.

819. **Œ. hæsita'ta.** (Lat. *hæsitata,* stuck; the describer was in doubt about it.) BLACK-CAPPED PETREL. Adult: Forehead, sides of head, neck all round, upper tail-coverts, base of tail and all under parts, white; back clear bistre-brown (nearly uniform, but the feathers often with paler or ashy edges), deepening on the quills and terminal half of tail; crown with an isolated blackish cap, and sides of head with a black bar (younger birds with the white of the head and neck behind restricted, so that these dark areas run together); bill black; tarsi and base of toes and webs, flesh-colored (drying yellowish); rest of toes and webs black. Young extensively dark below? Length 16.00; wing 12.00; tail 5.25, cuneate, its graduation 1.50; tarsus 1.40; middle toe and claw 2.12; bill 1.40, 0.66 deep at base, 0.40 wide; tube 0.33. Of casual occurrence on the Atlantic Coast, U. S. (*P. meridionalis*, Lawr., Ann. Lyc. Nat. Hist. N. Y., iv, p. 475; v, p. 220, pl. 15.)

887. (addenda). **Œ. gula'ris.** (Lat. *gularis*, pertaining to the throat.) PEALE'S PETREL. Form typically of *Œstrelata* as above given; size smaller. Adult: Upper parts, including tail-coverts and exposed surfaces of tail-feathers, pure cinereous, deepening to plumbeous on hind-head, rump, and lesser wing-coverts, the feathers of the back and greater and middle wing-coverts tipped with ashy-white. Under parts pure silky white, the ash of the upper coming down the sides of the neck and deepening as it extends more broadly along sides and quite across abdomen, which is plumbeous, this color with vague and nebulous boundaries; under wing- and tail-coverts white. Sides of head white, with a distinct narrow dark bar through eyes; a white superciliary line; forehead and crown mixed white and ashy. Primaries and secondaries with distinct pure white areas on inner webs; on the primaries these areas occupying the whole webs at base, sending a narrow wedge forward, included between dark areas of the webs; primaries lightening from without inward, secondaries abruptly darkening again. Bill black; tarsus livid flesh-color; basal third of toes and contained webs yellowish, the rest black. Young: Darker; especially more cloudy below; throat and crissum white. Chord of culmen 1.05; height of bill at base 0.45–0.50; width 0.40–0.45; tarsus 1.35; middle toe and claw 1.68; outer do. 1.65; inner do. 1.40. Wing 9.80; tail 3.90; graduated 0.75. Southern Seas; a waif caught in N. Y. State, Livingston Co., Apr. 1880. (Bull. Nutt. Club, vi, 1881, p. 91.)

887a. **Œ. fisheri.** FISHER'S PETREL. Closely related to the last; perhaps requiring confirmation. Above plumbeous-gray, blackish on lesser wing-coverts, the edges of the secondaries hoary white; head and lower parts white, the crown spotted with blackish, the belly overlaid by a wash of smoky plumbeous. Wing 10.15; tail 4.00; culmen 1.00; tarsus 1.35; middle toe 1.40. Off coast of Alaska (Kodiak). (Proc. U. S. Nat. Mus., v, 1883, p. 656.)

820. **Œ. bul'weri.** BULWER'S PETREL. A small sooty-colored species, with cuneate tail more than half as long as wings, not typical of *Œstrelata*, perhaps forming a genus apart (*Bulweria*). Length about 10.00; wing 8.00; tail 4.50, graduated 1.75; bill 0.85 (chord of culmen), of ordinary *Œstrelata* shape; tarsus 0.90–1.00; middle or outer toe and claw 1.10; inner do. 0.85. Plumage entirely fuliginous, almost black on wings and tail, lighter and more brownish below, somewhat ashy on head, gray on greater wing-coverts. Canary Islands, etc.; has once occurred in Greenland (or Labrador). (Pr. Phila. Acad., 1866, p. 158; Zoöl., 1881, p. 378.) Egg white, 1.60 to 1.75 by 1.20, laid in rocky burrows; young covered with sooty down.

OBS. There is a Jamaican species, *Œ. carribæa* N., which should fly to N. Am. some time.

325. **HALOCYPTE'NA.** (Gr. ἅλς, *hals*, the sea, ὠκύς, *okus*, swift, πτηνός, *ptenos*, winged.) PYGMY PETREL. Like a miniature *Œstrelata* or *Pterodroma;* unicolor, fuliginous. Bill much shorter than head, about ½ the tarsus, weak and slender, acutely hooked; nasal tubes as in *Procellaria* proper. Wings folding beyond tail, 2d primary longest, 3d nearly equal, 1st about equal to 4th. Tibia briefly bare below; tarsus little longer than middle toe and claw; outer toe without claw as long as middle; tip of inner claw reaching base of middle; hallux minute; webs moderately full; claws compressed, curved, acute. Tail rather long, wedge-shaped; central feathers projecting; lateral regularly graduated, narrowly rounded. One species.

321. **H. microso'ma.** (Gr. μίκρος, *mikros*, small; σῶμα, *soma*, body.) LEAST PETREL. Plumage lustrous brownish-black, darker above, blackening on wings and tail, browning on under parts, graying on greater wing-coverts and inner quills; bill and feet black; no white anywhere. Length 5.75; wing 4.75; tail 2.50, graduated 0.35; bill 0.50; gape 0.62; height at base 0.19, width 0.21; nasal tube 0.22; tibia bare 0.30; tarsus 0.90; middle toe and claw 0.82; outer do. 0.80; inner do. 0.68. A queer little bird, from the coast of Lower Cala.

326. **PROCELLA'RIA.** (Lat. *procella*, a tempest.) STORMY PETRELS; "MOTHER CAREY'S CHICKENS." Diminutive, fuliginous, with white. Bill small, short, compressed, sides rapidly

converging to narrow tip; less than half as long as head, about half the tarsus. Wings folding beyond tail; 2d primary longest, 3d little shorter, 1st less than 4th. Tibia briefly bare below; tarsus equal to middle toe and claw; claws compressed, curved, acute. Tail rounded or nearly square, with broad feathers; under tail-coverts very ample. Several species, distinguished by shape of tail from those of the preceding or following genus.

822. **P. pela'gica.** (Gr. πελαγικός, *pelagikos*, oceanic.) STORMY PETREL. Above, glossy brownish-black, below more fuliginous; upper tail-coverts white, with black tips; white streaking on crissum, and usually white touches under the wings. Bill and feet black; no yellow on webs. Size of the last; wing about 4.50. Common (?) off the Atlantic Coast; not known to breed on our side. This is the rarest of the three little black white-rumped "Mother Carey's chickens" of our Atlantic Coast, easily distinguished by its short legs and square tail; Leach's, the most numerous, is also short-legged, but larger and forked-tailed; Wilson's is intermediate, with square tail, but very long stilt-like legs, flat claws, and a yellow spot on the webs.

327. **CYMOCHORE'A.** (Gr. κῦμα, *kuma*, a billow; χορῆα, a dancing.) SOOTY FORK-TAIL PETRELS. Bill much shorter than head, about ⅔ as long as tarsus, rather stout, as high as or higher than wide at base, the hook strong and acute; nasal tube less than half as long as culmen. Wings moderately long, folding little beyond tail; 2d primary longest; 1st longer than 4th. Tail very long, deeply forked, the feathers all broad, obtusely rounded. Legs short; tibia little bare below; tarsus equal to middle toe and claw, or slightly longer. Of rather large size (for this group) and robust form. Color fuliginous, unicolor or nearly so. Three or four species are known.

Analysis of Species.

Upper tail-coverts white.
- General plumage sooty-brown . . . . . *leucorrhoa* 823

No white anywhere.
- Sooty-brown; large; wing 6.75; tail 4.00, forked 1.00 or more . . . . . *melæna* 824
- Sooty-gray; small; wing 5.00; tail 3.25, forked about 0.50 . . . . . *homochroa* 825

823. **C. leucor'rhoa.** (G. λευκός, *leukos*, white; ὄρρος, *orhros*, rump. Fig. 525.) LEACH'S PETREL. WHITE-RUMPED PETREL. Coloration as in the last species, with white upper tail-coverts, forming a conspicuous mark; but apt to be lighter — rather of a grayish or even ashy hue on some parts; but easily recognized, whatever the shade of color. Bill and feet black; iris brown. Length about 8.00; extent 17.50; wing 6.00–6.50; tail 3.00–3.50, forked about 0.75; tarsus 1.00; middle toe and claw the same; bill 0.67. N. Am., both coasts, and W. coast of Europe. Abundant on our N. Atlantic coast, breeding from New England northward. Nest in burrows in the ground; egg single, white.

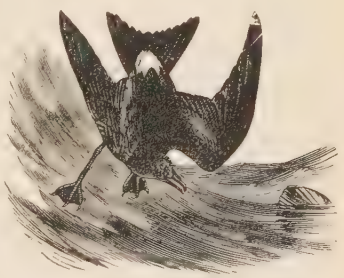

FIG. 525. — Leach's Petrel, much reduced. (From Tenney, after Audubon.)

824. **C. melæ'na.** (Gr. μέλαινα, *melaina*, black. Fig. 526.) BLACK PETREL. Form of the last very nearly; bill more robust; tarsus a little longer than middle toe and claw. No white anywhere. Plumage sooty brownish-black, darkest above and on head, more smoky-brown on under parts, grayer on wing-coverts, quite black on wing- and tail-feathers; bill and feet black; iris brown. "Length 9.00; extent 18.50;" wing 6.75; tail 4.00, forked 1.20; tibia bare 0.50; tarsus 1.25; middle toe and claw 1.10; bill 0.60; gape 0.95; height or width at base 0.25; nasal tubes 0.30. Cape St. Lucas, L. Cala.; a rare and little known species.

825. **C. homo'chroa.** (Gr. ὁμός, *omos*, like, equal; χρόα, *chroa*, color.) Somewhat like the last; smaller, with short, weak, compressed bill, and tarsus no longer than middle toe and claw. No white anywhere. Plumage dull plumbeous or slaty-blackish, more smoky-brownish on lower parts, lighter grayish-brown on greater wing-coverts; wings and tail black. 2d primary

longest, 3d nearly equal, 1st longer than 4th. The general plumbeous or bluish-ashy cast of the plumage is quite different from the sooty shade of *C. melæna*, approaching the condition seen in species of *Oceanodroma*. Length about 7.25; wing about 5.00; tail 3.25, forked 0.60; tarsus 0.90; middle toe and claw the same; bill 0.50; gape 0.75; height or width at base 0.20; nasal tubes 0.24. Farallone Islands, Cala.; another rare and little known species.

Fig. 526.—Black Petrel, nat. size. (Ad nat. del. E. C.)

328. **OCEANO'DROMA**. (Gr. *Ὠκεανός, Okeanos*, Lat. *Oceanus*, the divinity of the sea; *δρόμος, dromos*, running.) Gray Fork-tail Petrels. Bill small, weak, much compressed. Wings short; 2d and 3d primaries equal and longest, 1st shorter than 4th. Tail long, deeply forked, with broad medium and narrow external feathers. Feet as in *Cymochorea*. Coloration peculiar; bluish or grayish, and white.

826. **O. furca'ta**. (Lat. *furcata*, forked.) Gray Fork-tailed Petrel. Bluish-ash, paler or whitish below and on the greater wing-coverts, dusky about the eyes; lesser wing-coverts sooty; quills and tail brownish, the primaries pale or white on their inner edges, outer web of outer tail-feather white; bill and feet black. Length about 8.00; wing 6.00; tail 4.00, deeply forked; bill 0.60; tarsus 0.87; middle toe and claw the same. N. Pacific coast, common.

827. **O. horn'byi**. (To Admiral Hornby, R. N.) Hornby's Fork-tailed Petrel. Front, cheeks, throat, collar round neck, breast, and abdomen, pure white; crown, hind head, a broad band in front of neck, bend of wing and lesser wing-coverts, sooty-gray; upper part of back gray; lower part of back, and tail ashy-gray; greater wing-coverts brownish-gray; tertiaries and quills black. Length 8.25; tail 3.75; tarsus 1.00; middle toe about the same; bill along culmen 0.60; along rictus 0.90. N. W. coast. I have never seen this rare species, of which there are not to my knowledge any specimens in this country.

329. **OCEANI'TES**. (Gr. *Ὠκεανίτης, Okeanites*, son of the sea.) Wilsonian Stormy Petrels. Very different from any of the foregoing "stormy" petrels in great length of the legs, like stilts. Bill short, weak, compressed, not ½ as long as head, about ⅔ the tarsus, with sides a little concave, hook small, and nasal tubes perfectly horizontal. Wings very long, 2d primary much the longest; 1st and 3d about equal; 4th much shorter. Tail moderate, about square (as in *Procellaria*); ample, with feathers broad to their very tips. Tibia denuded an inch or more. Tarsi presenting the character, remarkable if not unique among water birds, of being covered in front and on sides by a continuous plate or "boot," as in a thrush, the ordinary scutella being fused. Toes, though long, only about ⅔ the greatly lengthened tarsi; hind toe so minute as to be liable to be overlooked. Claws broad, flat, obtuse. There are several species of this notable genus.

828. **O. ocea'nicus**. (Lat. *oceanicus*, oceanic.) Wilson's Stormy Petrel. Coloration much as in *P. pelagica* or *C. leucorrhoa*; dark sooty-brown, pale gray on the wing-coverts, black on wings and tail; the upper tail-coverts, and frequently the crissum and sides of rump and base of tail, white; bill and feet black, but webs with a yellow spot; iris brown. Length 7.00–8.00; extent about 16.00; wing about 6.00; tail 3.00, nearly even; tibia bare 1.00; tarsus 1.30; middle toe and claw 1.10; bill 0.50. One of the commonest and best known species, widely dispersed over the globe; said to breed on our N. Atlantic coast. Nest in burrows in the ground; egg single, white.

330. **FREGET'TA**. (Ital. *fregata*, a frigate.) Stilt Stormy Petrels. Resembling *Oceanites* in the great length of leg, flat obtuse claws, and other characters. Bill stout, about as high as broad at base, half as long as head, with long high nasal tube. Wings moderately long, folding just beyond the tail; 2d primary longest; 3d nearly equal; 1st between 3d and 4th. Tail ample, square, with broad feathers, square-tipped. Tibiæ bare an inch or more; tarsus

nearly half as long again as middle toe. Toes short, with small narrow webs; claws flat, broad, rounded. Colors blackish and white. Several species of Southern Seas, one straggling to our country.

829. F. gralla'ria. (Lat. *grallæ*, stilts.) LAWRENCE'S STILT PETREL. WHITE-BELLIED PETREL. Blackish-gray of variable intensity, blackening on the quills and tail, the whole under parts from the breast, the upper tail-coverts, most of the under wing-coverts, and bases of all the tail-feathers, except the middle pair, white; bill and feet black. Length about 8.00; wing 6.00–6.50; tail 3.00, about even, with very broad, square-tipped feathers; bill 0.50; tarsus 1.33; longest toe (outer) and claw 1.00 or less; tibiæ bare 1.00 or more. Florida, accidental, one instance (Lawr. Ann. Lyc. Nat. Hist. N. Y., v, 117).

331. PRIO'FINUS. (*Prion* + *Puffinus*.) FULMAR SHEARWATERS. Of large size and robust form. Bill a little shorter than head, about ¾ as long as tarsus, broad and stout at base, narrowing regularly to the strong, much compressed and hooked tip; under mandible hooked to correspond with the upper, with concave gonys (as in *Puffinus*). Nasal tubes long, very broad, depressed (as in *Puffinus*), but vertically truncate and with thin partition (as in *Fulmarus*). Wings rather short, the primaries broad and stiff, 2d as long as 1st. Tail rather short, of 12 feathers, the central projecting and a little acuminate, lateral more rounded, and rapidly graduated. Feet large and stout, as in *Puffinus;* tarsus shorter than middle toe and claw; outer toe longer than middle; tip of outer claw about reaching base of middle. A genus remarkably connecting the fulmars with the shearwaters; nearest the latter. A few species, if more than one, chiefly of Southern Seas.

830. P. melanu'rus. (Gr. μέλας, *melas*, black; οὐρά, *oura*, tail.) SMUTTY-NOSED SHEARWATER. BLACK-TAILED SHEARWATER. Upper parts cinereous, nearly uniform, but some of the feathers with paler edges; under parts white, without line of demarcation from the color of the upper parts; *tail, crissum, and vent blackish;* lining of wings, axillars, and some feathers on the sides of the body, brownish-cinereous; quills blackish-cinereous on outer webs and tips, paler internally and basally, with brown shafts. Bill *yellow*, the nasal case, culmen as far as the hook, cutting edge and groove of lower mandible, *black*, these varied colors very conspicuous in life; feet (dried) dingy greenish with yellow webs. Large: 19.00; wing 13.00; tail 5.00–5.75, wedge-shaped, 12-feathered, the outer feathers an inch or more shorter than the middle; bill 1.80, 0.67 high and 0.60 wide at base, the nasal tubes nearly 0.50; tarsus 2.40; middle toe and claw 2.88. Accidental off the coast of California. A peculiar species, very different from any of the following, approaching the fulmars. *Proc. melanura* Bonn. *Proc. hæsitata* Forst., Descr. Anim., 1844, p. 208; Gould, B. Aust., pl. 67. *Puffinus hæsitatus* Lawr., Ann. Lyc. Nat. Hist. N. Y., vi, p. 5. *Proc. adamastor* Schlegel. *Adamastor typus* Bonap. *Puffinus cinereus* Lawr. in Bd., B. N. A., 1858, p. 835. *Adamastor cinereus* Coues, Proc. Phila. Acad., 1864, p. 119; *Priofinus cinereus* Coues, Proc. Essex Inst., v, 1868, p. 303. *Priofinus melanurus*, Coues, 2d ed. Check List, 1882, p. 127. *Puffinus kuhlii* Cass., Proc. Phila. Acad., 1862, p. 327 (err.)

332. PUF'FINUS. (Latinized from Eng. *puffin*.) SHEARWATERS. Bill nearly or about as long as head, ⅔–¾ as long as tarsus, varying in slenderness, a little higher than broad at base, compressed for the rest of its extent; the end much hooked, tips of both mandibles decurved, making the gonys concave. Nasal tubes short, only about ¼ the length of culmen, broad and depressed, obliquely truncate at end, the partition thick, the nostrils oval. Wings long, thin, and pointed, folding beyond the tail; 1st primary longest. Tail more or less lengthened, rounded or rather wedge-shaped, of 12 feathers. Feet very large and stout; tarsus compressed, equal to middle toe with or without claw; outer toe about as long as middle, but its claw much smaller; tip of inner claw scarcely or not reaching base of middle; hind toe a mere knob. Embracing numerous species, of moderate and small size; a portion of them bicolor, dark above and white below, the others uniformly sooty.

Analysis of Species.

Two-colored; white below, dark above.
- Large; length 16.00 or more; wing 12.00 or more.
  - Pale brownish-ash; under tail-coverts white, upper largely dark. Atlantic . . *borealis* or *kuhli* 831
  - Dark brown; under tail-coverts dark, upper largely white. Atlantic . . . . . *major* 832
  - Dark brown; under and upper tail-coverts dark; feet flesh-color. Pacific . . . . . *creatopus* 833
- Medium; length under 16.00, over 13.00; wing 9.25. Above blackish. Atlantic . . . . *anglorum* 834
- Small: length 13.00 or less; wing 9.00 or less.
  - Under tail-coverts mostly white. Atlantic . . . . . *obscurus* 835
  - Under tail-coverts mostly black. Pacific . . . . . *opisthomelas* 836

One-colored; sooty.
- Large: length 16.00 or more; wing 11.00 or more.
  - Under wing-coverts mostly dark. Atlantic . . . . . *fuliginosus* 837
  - Under wing-coverts mostly white. Pacific . . . . . *amaurosoma* 838
- Small: length about 14.00; wing 10.00. Pacific . . . . . *tenuirostris* 839

831. P. kuhl'i. (To Dr. H. Kuhl.) CINEREOUS SHEARWATER. MEDITERRANEAN SHEARWATER. Bill scarcely or not shorter than head, equal to tarsus, moderately hooked for a shearwater, with short nasal tubes, about $\frac{1}{3}$ as long as culmen, but rather high for this genus, with trace of a median ridge; nostrils opening roundish; wings folding a little beyond the tail, which is graduated, with lengthened middle feathers; feet rather weak; outer toe and claw longer than middle toe and claw; tip of inner claw about reaching base of middle. Upper parts light smoky-gray, or pale brownish-ash, uniform on crown and nape, interrupted on back by white or grayish-white edges of the feathers, especially on the scapulars, darkening on the wing-coverts and tertials to grayish-brown. Rump like back; upper tail-coverts successively acquiring white till the longest ones are mostly of this color, only touched with brown. Primaries grayish-black, with large white spaces on basal half or two-thirds of inner webs. Outer webs and tips of secondaries grayish-plumbeous; most of their inner webs white. Entire under parts, from chin to ends of under tail-coverts, pure white, excepting some slight touches of gray on the flanks; lining of wings and axillars white, except just along the edge. On sides of head and neck, no line of demarcation between color of upper and under parts, the two merging through a cloudy or wavy area; under eyelid white. Bill yellowish, darker on culmen and hook; feet yellowish, the webs clearer. Length about 18.00; wing 13.00; tail 5.50, graduated 0.75; chord of culmen 1.90, gape 2.60; height of bill at base 0.70, width 0.60; tarsus 1.90; middle toe and claw 2.50, outer do. 2.55. (Described from a European specimen.) N. Atlantic, European coast, especially of the Mediterranean. Greenland? I am not yet satisfied that bird really occurs on our coast. I introduced it to our Fauna in 1872, in the orig. ed. of the Key, but upon strength of its general range, and Schlegel's ascription of it to Greenland; and have never seen an unquestionable N. Am. specimen. It probably occurs, however.

888. (addenda). **P. borea'lis.** (Lat. *borealis*, northern.) CORY'S SHEARWATER. "Above brownish-ash, the feathers of the back becoming pale at the tips, those on the nape and sides of the neck narrowly tipped with white; on the sides of the head and neck the ash and white gradually mingling as in *P. kuhlii*. Tips of the upper tail-coverts, white. Under eyelid, white, showing clearly in contrast with the ashy-gray of the head. The first three primaries are light ash on the inner webs. Wings and tail brownish-gray. Under parts white, slightly touched with ash on the flanks, lining of wings white. Under tail-coverts white, the longest tinged with ash near the ends, which extend nearly to the tips of the longest tail-feathers. Outside of foot greenish-black, inside and webs dull orange; bill pale yellowish at the base, shading into greenish-black, but again becoming pale near the tip. Length 20.50 inches; wing 14.50; bill (straight line to tip) 2.25; depth at base 0.75; tail 6.50; tarsus 2.20." Coast of Massachusetts; several specimens now known. I copy the original description. (Bull. Nutt. Club, vi, 1881, p. 84.) The bird is perfectly distinct from *P. major*, but very near *P. kuhli*, if really different.

832. P. ma/jor. (Lat. *major*, greater.) Greater Shearwater. Wandering Shearwater. Common Atlantic Shearwater. Bill scarcely shorter than head or tarsus, stout and subcylindrical at base, then more and more compressed to the strong hook. Nasal tube straight, about ¼ as long as culmen, with widely separated subelliptical openings. Culmen rising with slight continuous concavity from nostrils to top of the hook; commissure a long regular curve, convex downward, from feathers to curve of the hook. Outline of inferior mandibular rami about straight. Bill about 3 times as long as high at base, not so wide as high. Wings long and pointed; 1st and 2d primaries nearly equal. Tail contained about 2⅓ times in length of wing, much rounded, almost wedged. Tarsus as long as middle toe without claw; outer toe as long as or longer than middle, but its claw smaller, falling short of tip of middle claw; tip of inner claw not reaching base of middle. Above, dark bistre-brown, on head inclining a little to plumbeous or grayish-brown; usually lighter on hind neck, darkest on tertials and rump; each feather of back, rump, and wing-coverts, edged with pale brownish-ash or even ashy-whitish. On the head the color uniform, without these light margins, extending below eyes to level of the gape, with distinct line of demarcation from white of the throat. On side of neck the white reaches further around, and is less distinctly outlined; further back, on sides of breast, the dark color encroaches on the white. The upper tail-coverts, especially the long posterior ones, are mostly white, with dark bars on central fields. Primaries brownish-black, lightening on inner webs towards base. Under parts white from chin to anus, with large dark brown patches on flanks; under tail-coverts dark grayish-brown, with whitish tips; lining of wings white, mottled with dark along the border and on ends of axillars. Tail-feathers like primaries. Bill dark blackish horn color; outside of tarsus and outer toe brownish; rest of feet and webs yellowish flesh-color; iris brown. The intensity and uniformity of coloration of the upper parts varies much with age of the plumage. Fresh plumages are deep plumbeous-brown with narrow pale or whitish margins; old worn feathers are duller brown with broader less distinct grayish-brown edgings. Observe line of demarcation of dark and white on head, neck and breast; uniform feathers of head; dark under and partially white upper tail-coverts. Audubon gives "bill yellowish-green, the tips brownish-black, tinged with green; feet light greenish-gray, webs and claws yellowish flesh-color." Length 18.00–20.00; extent 42.00–45.00; wing about 13.00; tail 5.75, graduated 1.00; tarsus 2.40; middle toe and claw 2.90; outer do. 2.75; inner do. 2.30; chord of culmen 2.00; depth of bill at base 0.65, width 0.60. Wanders over the whole Atlantic, Greenland to Cape Horn and Good Hope. Abundant, sometimes seen in flocks of thousands, shearing the crests of the waves, and skimming the billows with marvellous ease, without a visible motion of the pinions.

833. P. crea/topus. (Gr. κρέας, *kreas*, flesh, πούς, *pous*, foot.) Flesh-footed Shearwater. Resembling the last, but quite distinct. Bill short, less than head or tarsus, turgid at base, where as wide as high. Nasal tubes short, hardly ¼ the length of culmen, turgid, with slight median furrow and very oblique truncation. Frontal feathers running forward on median line. Form otherwise as in *P. major*. Bill pale yellowish flesh-color, the nasal tubes, culmen, and tip blackish. Feet flesh-colored; claws whitish with brown ends. Upper parts about the same shade of brown as in *P. major*; upper tail-coverts entirely dark. No white on inner webs of primaries. On sides of head and neck, the color of the upper parts extends entirely around, without any distinct line of demarcation, the chin and throat mottled with dark and white in about equal amounts. On the sides of the breast the color more restricted than on the neck. Lower eyelid white. Sides of body and lining of wings mottled with dusky and white in about equal amounts; long axillars entirely dark except just at base. Middle of belly and vent region variegated with dusky and white. Under tail-coverts entirely fuliginous black. "Length 19.00; extent 45.00;" wing 12.50; tail 5.00, graduated 1.00; tarsus 2.10; outer toe and claw 2.50; middle do. 2.65; inner do. 2.60; chord of culmen 1.60; gape 2.30; height or width of bill at base 0.60; nasal tubes 0.40. San Nicholas Island, Coast of Cala.; a curious species of which little is known.

834. P. anglo'rum. (Lat. *Anglorum*, of the English.) MANX SHEARWATER. Smaller and otherwise very different from any of the foregoing. Upper parts uniform lustrous black, or blackish with slight brown shade, rather ashy across hind neck; the dark color extending on sides of head much below eyes, but there marbled with white; under eyelid white, set in black. On sides of neck the white reaches part way around; on sides of breast the dark extends some distance, dilute and marbled with white. Primaries black, with black shafts, their inner webs dull grayish-brown; tail-feathers like primaries. Entire under parts, from chin to anus, pure white, except a few feathers of the flanks, and the outer webs of the outer under tail-coverts, which are plumbeous-black. Lining of wings and axillars white, mottled with black just along the edge. Length about 13.50; extent 30.00; wing 9.25; tail 4.00, graduated 0.75; tarsus 1.80; middle toe and claw 1.90; outer do. 2.00; inner do. 1.55; chord of culmen 1.40; gape 2.10; height or width of bill at base 0.45. Varies much, but the small size and blackishness are distinctive. This species chiefly inhabits the Atlantic coast of Europe, and the Mediterranean; it is the commonest British species of the genus, said to range the N. Atlantic at large, and to occur on our coast; but those who suppose it to be one of our common species are apparently mistaken. Nest in burrows in the ground, dug by the birds; egg single, dead white, smooth, 2.35 × 1.60.

835. P. obscu'rus. (Lat. *obscurus*, dusky.) DUSKY SHEARWATER. Bill small and weak, about ⅔ as long as head, ¾ as long as tarsus; stout only at base, where higher than wide; hook rising abruptly from line of culmen; commissure lower, and outline of bill almost straight from feathers to hook. Wings folding to end of tail, which is comparatively long, and much graduated. Tarsus as long as middle toe without claw; outer toe and claw equal to middle toe and claw; tip of inner claw reaching base of middle. Blackish of upper parts with much grayish or plumbeous cast, with lighter borders of the feathers, especially on the scapulars and tertials; darkest on rump and upper tail-coverts; on sides of head not extending below eyes, and even there marbled with whitish; both eyelids white, and there is indication of a light superciliary stripe. Quills and tail-feathers as in *P. anglorum*. Under parts from chin to vent, white, as are lining of wings and axillars, only a few plumbeous black feathers on flanks. The longest and outermost under tail-coverts are black, the rest white, pure or with a plumbeous shade. Bill dull leaden-blue, blackening at tip; iris bluish-black; edges of eyelids bluish; outside of tarsus and outer toe bluish-black, inside and webs of all yellowish flesh-color. Small: length 11.00–12.00; extent 26.00; wing 7.50–8.00; tail 4.25, graduated nearly 1.00; tarsus 1.60; middle toe and claw 1.80; chord of culmen 1.25; gape 1.70; nasal case to tip 0.90; depth of bill at base 0.40; width 0.35. A small bicolor species, readily distinguished from any of the foregoing. S. Atlantic and Gulf coast, common, straying N. to the Middle States. (*P. obscurus* Gm.? *P. auduboni* Finsch.)

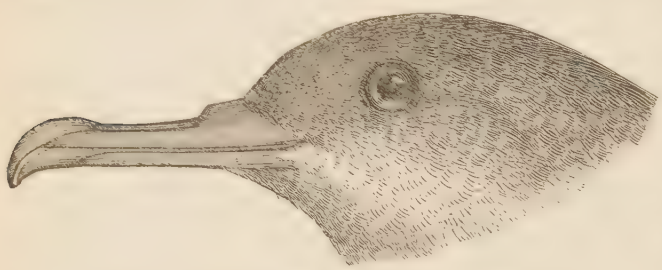

FIG. 527. — Black-vented Shearwater, nat. size. (From Elliot.)

836. P. opistho'melas. (Gr. ὄπισθε, *opisthe*, backward; μέλας, *melas*, black. Fig. 527.) BLACK-VENTED SHEARWATER. Resembling the last, and little larger. Bill about ⅔ as long as tarsus. Tail relatively shorter, less graduated. Tarsus as long as middle toe and half its claw. Frontal feathers extending in a point on culmen. Dark color of upper parts extending farther on sides of head than in *obscurus*, leaving no white about eye. Under tail-coverts entirely sooty-

blackish, except a few of the shortest just at the vent. More dark color on flanks, on lining of wings and axillars than in *obscurus*. In the dry state, bill yellowish or reddish-brown, the nasal tubes and culmen blackish, the hook mostly bluish-white. Outside of tarsus for the most part, outer toe and edges of webs, blackish; rest of foot pale yellowish flesh-color; "iris brown." Wing about 9.00; tail 3.75, graduated 0.60; tarsus 1.80; middle toe and claw 2.10; chord of culmen 1.40; gape 2.00; end of nasal tubes to tip 1.05; height at base 0.42, at hook 0.32. Cape St. Lucas, L. Cala. Decidedly different from *P. obscurus*. (*P. gavia* Forst. ?)

837. **P. fuligino'sus.** (Lat. *fuliginosus*, sooty. Fig. 528.) SOOTY SHEARWATER. Very different from any of the foregoing. Nearly uniform dark sooty-brown, blackening on quills and tail-feathers, more sooty-gray below, paler still on the throat; lining of wings mixed sooty and whitish. Bill drying an undefinable dark color, in life dusky bluish-horn color, the tube, ridge, and hook blackish; feet drying dark outside, pale inside; in life the inside of tarsus and upper side of feet livid flesh-color, the outside of outer toe and under side of feet blackish; eye blackish. Length about 18.00, rather less than more; extent about 40.00; wing 12.00; tail 4.00; tarsus 2.25; middle toe and claw 2.50; chord of culmen 1.75–2.00; gape 2.33; feathers on side of lower mandible to tip 1.67; depth of bill in front of nasal tube 0.40. A wide-ranging species; common off our Atlantic coast, especially northerly. It is perfectly distinct from any of the two-colored species, of several of which it has at times been considered to be the ♀ or a special state of plumage. Breeds in colonies, often of great extent, laying a single egg in holes burrowed several feet deep in the ground.

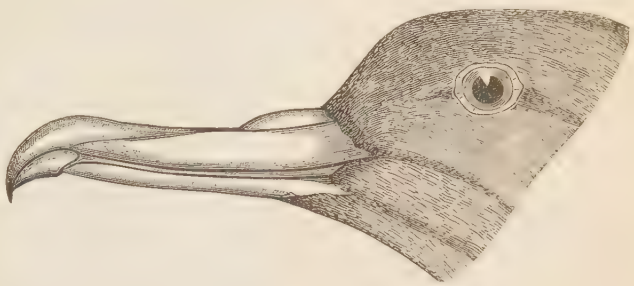

FIG. 528. — Sooty Shearwater, nat. size. (Ad nat. del. E. C.)

838. **P. amauroso'ma.** (Gr. *ἀμαυρός*, *amauros*, dark; *σῶμα*, *soma*, body.) DARK-BODIED SHEARWATER. Similar to the last, from which perhaps not specifically distinct. Under wing-coverts white, only interrupted by some dusky marbling. Bill (dry) brownish-black, horn-colored at tip. Feet (dry) light yellowish flesh-color, tinged with brown on outside of tarsus, outer toe, and tips of claws. Smaller: wing 11.00; tail 4.25, graduated 0.90; tarsus 2.00; middle toe and claw 2.40; outer do. 2.30; chord of culmen 1.70. Cape St. Lucas, Cala.

839. **P. tenuiros'tris.** (Lat. *tenuis*, slight, thin; *rostrum*, beak.) SLENDER-BILLED SHEARWATER. Distinct: a small, weak-billed, short-tailed, very dark-colored species, sooty-black above, quite black on quills and tail-feathers, beneath smoky-gray, palest on throat, the under tail-coverts nearly as blackish as the upper parts. Groove of under side of primary-shafts yellow. Bill (dry) dusky greenish-yellow, brighter along edges and at tip; feet (dry) yellowish, the hinder edge of tarsus and under surface of webs blackish. Length about 14.00; wing 10.00; tail 3.50, graduated 0.75; chord of culmen 1.20; depth of bill at base 0.30; width 0.40; tarsus 1.90; middle or outer toe and claw 2.25. N. Pacific, Sitka to Japan.

XIII. Order PYGOPODES: Diving Birds.

In the birds of this order the natatorial plan reaches its highest development. All the species swim and dive with perfect ease; many are capable of remaining long submerged, and of traversing great distances under water, progress being effected by the wings as well

as by the feet. Few other birds, such as cormorants and anhingas, resemble the *Pygopodes* in this respect. The legs are so completely posterior, that in standing the horizontal position of the axis of the body is impossible: the birds rest upright or nearly so, the whole tarsus being often applied to the ground, while the tail affords additional support; progression on land is awkward and constrained, only accomplished, in most cases, with a shuffling motion, when the belly partly trails on the ground. One species of auk could not fly at all, because the wings, although perfectly formed, were too small to support the body. The rest of the order fly swiftly and vigorously, with continuous wing-beats. The rostrum varies in shape with the genera; but it is never extensively membranous, nor lamellate, nor furnished with a pouch. The nostrils vary, but are neither tubular nor abortive. The wings are short, never reaching when folded to the end of the tail. The tail is short, never of peculiar shape, generally of many feathers: there are, however, no perfect rectrices in the grebes. The crura are almost completely buried, and feathered nearly or quite to the heel. The tarsus is usually compressed, sometimes, as in the loons, extremely so. The front toes are completely palmate in the loons and auks; lobate, with basal webbing, in the grebes; the hallux is present and well formed, with a membranous expansion, in loons and grebes, wanting in the auks. The plumage is thick and completely waterproof: once observing some loons under peculiarly favorable circumstances in the limpid water of the Pacific, I saw that bubbles of air clung to the plumage whilst the birds were under water, giving them a beautiful spangled appearance. The pterylosis shows both contour and down-feathers, both after-shafted; there are definite apteria; the auks have free outer branches of the inferior tract-bands, wanting in the loons and grebes. The oil-gland is large with several orifices. Among osteological characters should be particularly mentioned the long apophysis of the tibia found in the loons and grebes, but not in the auks. In auks, the elbow has two sesamoids. The thoracic walls are very extensive; the long jointed ribs grow all along the backbone from the neck to the pelvis, and form with the long broad sternum a bony box enclosing much of the abdominal viscera as well as those of the chest, perhaps to prevent their undue compression under water. The top of the skull has a pair of crescentic depressions for lodgment of a large gland: the palate is schizognathous. The sternum has a different shape in each of the families. There are two carotids, except among the grebes, and in *Alle*. The digestive system shows minor modifications, but accords in general with the piscivorous regimen of the whole order. The sexes are alike; the young different; the seasonal changes often great. The auks are altricial, the loons and grebes præcocial. There are three families of *Pygopodes*, sharply distinguished by external characters; all of them are fully represented in this country, where all the known species of loons and auks occur. The penguins (*Spheniscomorphæ*), formerly included in this order, are better left to stand by themselves; they are confined to the Southern Hemisphere, where they are represented by several genera (as *Aptenodytes*, *Pygoscelis*, *Eudyptes* and *Spheniscus*) and about 18 species. The wings are reduced to mere flippers, without true remiges, unfit for flight, but very efficient as fins in swimming under water. Much of the plumage is harsh and scaly. There are numerous osteological characters, among them the flatness and solidity of the wing-bones, and the incomplete fusion of the metatarsals. The elbow has a pair of sesamoids, and the knee a large irregularly shaped patella. The feet are four-toed, and palmate.

Analysis of Families.

Loons. Feet 4-toed, palmate . . . . . COLYMBIDÆ
Grebes. Feet 4-toed, lobate . . . . . PODICIPEDIDÆ
Auks. Feet 3-toed, palmate . . . . . ALCIDÆ

61. Family COLYMBIDÆ: Loons.

FIG. 529. — Loons. (From Michelet.)

Bill stout, straight, compressed, tapering, acute, paragnathous, entirely horny. Nostrils narrowly linear, their upper edge lobed. Head completely feathered, the antiæ prominent, acute, reaching the nostrils; no crests nor ruffs. Wings strong, with stiff primaries and short inner quills. Legs completely posterior, buried, feathered on to the heel-joint; tarsi entirely reticulate, extremely compressed, the back edge smooth; toes four, the anterior palmate, the posterior semilateral and having a lobe connecting it with the base of the inner. Tail short, but well formed, of many feathers. Carotids double. Tibia with long apophysis. Sternum with long, broad, central projection backward, and shorter lateral processes. Cœca present. Accessory semitendinosus absent. Back spotted. Head of young not striped. Loons are large heavy birds with broad flattened body and rather long sinuous neck, abundant on the coasts and large inland waters of the Northern Hemisphere. They are noted for their powers of diving, being able to evade the shot from a gun by disappearing at the flash, and to swim many fathoms under water. They are migratory, breeding in high latitudes, being generally dispersed further south in winter. They are præcocial, and lay two or three dark-colored spotted eggs in a rude nest of rushes by the water's edge. The voice is extremely loud, harsh, and resonant. The sexes are alike, the ♀ smaller than the ♂; the young different. There is but one genus, with only three well-determined species.

333. COLYM'BUS. (Gr. κόλυμβος, *kolumbos*, a diver.) LOONS. Character as above.

Analysis of Species and Varieties (Adults).

Head and neck black, with green, blue, and purple reflection, and patches of white streaks.
- Bill mostly or wholly black, the culmen, commissure, and gonys all gently curved; feathers falling short of middle of nostrils; culmen 3.00 or less; gape 4.00 or more; height of bill at nostrils usually under 1.00. Gloss of head and neck mostly green; white spots of back nearly square . . . *torquatus* 840
- Bill mostly yellow; culmen nearly straight; commissure straight; gonys straight; feathers reaching middle of nostrils; culmen about 3.75; gape about 5.00; height of bill at nostrils usually over 1.00. Gloss of head and neck mostly blue; white spots of back longer than broad . . . . . *adamsi* 841

Top of head bluish-ash, front of neck blue-black; neck with white stripes.
- Larger: wing about 12.00; bill about 2.50, stout, with convex culmen . . . . . *arcticus* 842
- Smaller: wing about 11.00; bill about 2.00, slender, with straight culmen . . . . . *pacificus* 843

Throat and sides of head bluish-ash; front of neck with red patch . . . . . *septentrionalis* 844

840. C. torqua'tus. (Lat. *torquatus*, collared. Figs. 529, 530.) COMMON LOON. GREAT NORTHERN DIVER. Adult: Bill black, the tip and cutting edges sometimes yellowish. Feet black. Iris red. Head and neck deep glossy greenish-black, with lustrous purplish reflections on the

front and sides of the head. A patch of sharp white streaks on the throat, and another larger triangular patch of the same on each side of the neck lower down, the two last nearly or quite meeting behind, separate in front. Sides of breast striped with black and white. Entire upper parts, wing-coverts, inner secondaries, and sides under the wings, glossy black; all except the sides thickly marked with white spots; those of the scapulars, tertials, and middle back, large, square, and regular; those of other parts smaller, oval, smallest on rump, most numerous on wing-coverts. Upper tail-coverts greenish-black, immaculate. Wing-quills brownish-black, lighter on inner webs. Under surface of wings, axillars, and under parts generally from the neck, pure white; the lower belly with a dusky band. The white throat-patch consists usually of five or six streaks; in this, as in the lateral neck-stripes, the individual feathers are broadly black, with sharp white edges toward their ends. The texture of these feathers is peculiar, — the outer surface is hollowed, with raised edges of specially firm, smooth, polished character, so that these patches may be *felt* as well as seen. The white spots on the back occur in a pair on each feather near its end, their aggregation in any region being therefore determined by the size of the feathers themselves. Young: Bill smaller than in the adult, bluish-white, with dusky ridge. Iris brown. Crown and hind neck dull brownish-black; other upper parts similar, but the feathers, especially of the fore back, with light gray edgings. Primaries black, with brown inner webs. Tail-feathers with gray tips. Traces of lighter and darker lineation on sides of breast. Sides of head mottled with ashy and whitish; chin, throat, neck in front, and whole under parts, white. Dimensions: length 31 to 36 inches; extent about 52.00; wing 12.50 to 14.25; bill 2.75 to 3.00 along culmen; gape 4.00 to 4.25; height at nostrils, about 0.80; width there about 0.40; tarsus 3.00 to 3.50; middle toe and claw 4.25 to 5.00. Inhabits the Northern Hemisphere. In winter, generally dispersed in the U. S.; breeds in portions of the U. S. and thence northward. Eggs 2, 3.50 × 2.25, elongate and pointed, dull greenish-drab, with dark brown spots. Young covered with stiffish black down.

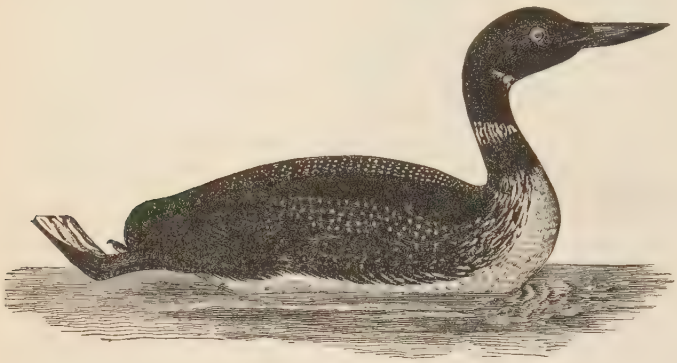

FIG. 530. — Common Loon. (After Wilson.)

841. C. t. a/damsi. (To Dr. C. B. Adams.) YELLOW-BILLED LOON. Larger than *C. torquatus*, with the bill rather larger and somewhat differently shaped and colored. Bill about equalling head, longer than tarsus, much compressed, tip very acute, not at all decurved, the culmen being almost perfectly straight, as the commissure also is. Gonys straight or nearly so to the angle, which is very prominent. (Fig. 530 shows the shape of the bill better than it does that of No. 840, for which it is intended.) Frontal antiæ reaching beyond middle of nostrils. Bill light yellowish horn-color, only dusky at base. Head and neck deep steel-blue, with purplish and violet reflections, glossed only on the cervix with green. Throat-patch of white streaks smaller than in *torquatus*, but the individual streaks larger, as are those of the neck-patches. White spots of upper parts larger than in *torquatus*, longer than broad instead of square on the scapulars and tertials. Bill along culmen 3.50 to 3.75; along gape 5.00 to 5.25; height at nostrils 0.95 to 1.10; width 0.40 to 0.50; tarsus 3.50; outer toe 4.65 to 5.10. General dimensions somewhat exceeding those of *torquatus*. Arctic America, common; perhaps specifically distinct from the last.

842. **C. arc'ticus.** (Lat. *arcticus*, arctic.) BLACK-THROATED DIVER. Bill generally as in *torquatus*, but smaller; color black. Chin, throat, and neck in front, black, with purplish and violet reflections on the sides of the head, gradually fading into a fine, clear bluish-gray, deepest on forehead, lightest behind, and separated from the black of the throat by a series of white streaks. A crescent of short, white streaks across upper throat; sides of breast striped with pure white and glossy black, these stripes nearly meeting in front. Entire upper parts deep, glossy greenish-black, each feather of scapulars and interscapulars with a white spot near end of each web; those of the scapulars largest, forming four patches in tranverse rows. Wing-coverts thickly speckled with small ovate white spots. Inner webs of quills, and tail-feathers below, light grayish-brown. Sides under wings like back. Lining of wings and entire under parts from the neck, pure white, with a narrow dusky band across lower belly; under tail-coverts dusky, tipped with white. Young: Bill light bluish-gray, dusky along the ridge. Iris brown. Feet dusky. Upper part of head and neck dark grayish-brown; sides of head dull grayish-white, minutely streaked with brown. Upper parts with a reticulated or scaly appearance, the feathers being brownish-black with broad bluish-gray margins; the rump dull brownish-gray. Primaries and their coverts brownish-black; secondaries and tail-feathers dusky margined with gray. Fore-part of neck grayish-white, minutely and faintly dotted with brown; its sides below streaked with the same. Lower parts, including under surface of wings, pure white, the sides of the body and rump, with part of the lower tail-coverts, dusky, edged with bluish-gray. (Audubon.) Dimensions: length about 30.00; extent 40.00; wing 12.00; bill along culmen 2.45; along gape 3.40; its height at nostrils 0.65; its width there 0.35; tarsus 2.90; outer toe and claw 3.80. N. Hemisphere; not common in the U. S.

843. **C. a. paci'ficus.** (Lat. *pacificus*, pacific.) PACIFIC BLACK-THROATED DIVER. Like the last; colors the same. Size less; length 24.00; wing 11.00. Bill shorter, slenderer, somewhat differently shaped, with straight culmen — much like the difference between *Æchmophorus occidentalis* and *Æ. clarki*. Bill along culmen 1.90–2.20; gape 3.00; length of bill 0.50 or less; tarsus about 2.50. N. W. America; abundant on Pacific coast of U. S. in winter.

844. **C. septentriona'lis.** (Lat. *septentrionalis*, northern.) RED-THROATED DIVER. Bill usually slenderer than in the foregoing; culmen slightly concave at the nostrils, gently convex to tip, which is rather obtuse and a little decurved. Outline of rami nearly straight; gonys slightly convex. Frontal antiæ scarcely extending beyond base of nostrils. Tarsus relatively rather longer than in foregoing species, about four-fifths the middle toe. Adult: Bill black, rather lighter at the tip. Crown and broad cervical stripe glossy greenish-black, the latter thickly streaked with white, which streaks, on the sides of the breast, spread so as to nearly meet in front. Throat and sides of head clear bluish-gray. A large, well-defined, triangular, chestnut-brown throat-patch. Entire upper parts and sides under the wings deep brownish-black, with greenish gloss, everywhere profusely spotted with white, the spots small, oval. Primaries blackish, paler on the inner webs. Tail narrowly tipped with white. Under parts and lining of wings white, the axillars with narrow dusky shaft-streaks, and the lower belly, with some of the under tail-coverts, dusky. Young: Bill mostly light bluish-white, with dusky ridge. Crown of head and neck behind bluish-gray, the feathers of the former bordered with whitish. Entire upper parts brownish- or grayish-black, everywhere profusely marked with small oval and linear spots of white. Throat without red patch, its sides and those of the head mottled with dusky. Other parts as in the adult. Length 25.00; extent 44.00; wing 11.00 or less; bill along culmen 2.00; along gape 3.00; height at nostril 0.50; width there 0.35; tarsus 2.75; outer toe 3.50. Varies greatly in size, and in the size and shape of the bill; recognized by the profuse spotting of the upper parts, as well as, when adult, by the red throat-patch. The spots are smallest and most numerous on the wing-coverts and upper back, where they grade into the streaks of the hind neck; largest on the tertials, scapulars, and sides under the wings, where they are rather lines than spots, and are fewest, or almost wanting, on the

middle of the back. The marking results from a small spot or stripe near the end of each feather, on the edge of each web: there is occasionally a second pair nearer the base of the feather. The amount of spotting is very variable with individuals; in the young the spots are always larger and more numerous than in the adults, and usually lengthened into oblique lines, producing a regular diamond-shaped reticulation. Northern Hemisphere at large: most of the U. S. in winter; breeds in high latitudes. Eggs 2–3, 3.00 × 1.75.

62. Family PODICIPEDIDÆ: Grebes.

Bill of variable length, much longer or shorter than head; culmen usually about straight, sometimes a little concave, or quite convex, especially at the end. Commissure nearly straight, but more or less corresponding with the curve of the culmen, usually sinuate at base. Under outline of bill in general convex, with slight gonydeal angle or none. Sides of bill more or less striate. Nasal fossæ well marked, the nostrils near their termination. Nostrils linear and pervious (broader in *Podilymbus*), upper edge straight, not lobed. Frontal extension of feathers considerable, and usually antiæ run still further into the nasal fossa. A groove along the symphysis of the mandible extends often nearly to the tip. Eyes far forward, with a loral strip of bare skin running thence to base of upper mandible, very narrow in the typical forms, broader in *Tachybaptes* and *Podilymbus*. Head usually adorned in the breeding season with variously lengthened colored crests or ruffs; when these are wanting the frontal feathers may be bristly. Neck usually long, slender, and sinuous. Plumage thick and compact, smoothly imbricated above, below of a peculiar smooth, satiny texture. Wings short but ample, very concavo-convex; primaries eleven, narrow, somewhat falcate, graduated, the three or four outer ones attenuate on one or both webs; secondaries short and broad; tertials very long, hiding the rest of the quills when the wing is closed. Bastard quills unusually long, their tips reaching over half-way to the ends of the primaries. Greater coverts also very long. Tail rudimentary, represented by a tuft of downy feathers. Characters of the feet peculiar; for in other lobe-footed birds, as Phalaropes and Coots, the lobation is of a different character. Tarsi exceedingly compressed, with only a slightly thickened tract within which the tendons pass. Front edge a single smooth row of overlapping, the hinder serrate with a double row of pointed, scales; sides regularly transversely scutellate, as are the upper surfaces of the toes, the latter being inferiorly reticulate, with an edging of pectinated scales. Toes flattened out and further widened with broad lobes, especially wide toward the end, and at base connected for a varying distance by interdigital webs. Hind toe highly elevated, broadly lobate, free. Claws short, broad, flat, obtuse, of squarish shape; that of the hallux minute.

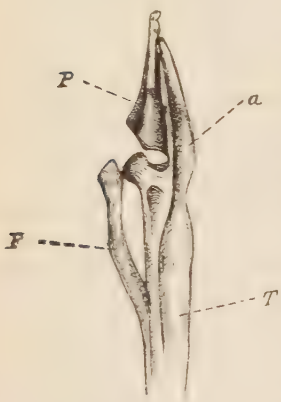

FIG. 530 *bis*. — *F*. fibula; T, tibia, with *a*, its cnemial process, and P, large patella, of a grebe: nat. size.

The Grebes are strongly marked by the foregoing characters, especially of the feet and tail, though they agree closely with the Loons in general structure and economy. Principal internal characters are the absence of one carotid, and of the ambiens, femoro-caudal and accessory semitendinosus muscles, the greater number of cervical vertebræ (19 instead of 13) and shortness of the sternum, with lateral processes reaching beyond the transverse main part (the reverse of the case in Loons). There is a long cnemial process of the tibia, reaching high above the knee-joint, backed by a large patella of about equal altitude (fig. 530 *bis*.). The gizzard has a special pyloric sac; there are cœca and a tufted oil-gland. These birds are expert divers, and have the curious habit of sinking back quietly into the water when alarmed, like Anhingas. Owing to the virtual absence of the tail, the general aspect is singular, ren-

dered still more so by the almost grotesque parti-colored ruffs and crests that most species possess. These ornaments are very transient; old birds in winter, and the young, are very different from the adults in breeding attire. The eggs are more numerous than in other pygopodous birds, frequently numbering 6–8; elliptical, of a pale or whitish color, unvariegated; commonly covered with chalky substance. The nest is formed of matted vegetation, close to the water, or even, it is said, floating among aquatic plants; the young swim directly. Grebes are the only cosmopolitan birds of the order, being abundantly distributed over the lakes and rivers of all parts of the world, though they are less maritime than the species of either of the other families. There are not over twenty-five well determined species.

Analysis of Genera.

Bill slender or only moderately stout, paragnathous, acute. Nostrils narrow or linear. Loral bare strip narrow. Frontal feathers normal. Tarsus generally but little, if any, shorter than the middle toe — at least three-fourths as long. Semipalmation of toes moderate. Lobe of hallux broad. Usually with conspicuous crests or ruffs during the breeding season.

- Bill longer than head, extremely slender and acute. Tarsus equal to the middle toe and claw. Crests and ruffs slight. Large . . . . . *Æchmophorus* 334
- Bill not longer than head, moderately stout. Tarsus shorter than middle toe and claw. Crests and ruffs decided. Size over 10 inches . . . . . *Podicipes* 335
- Bill much shorter than head, not two-thirds the tarsus, quite stout. Tarsus about three-fourths the middle toe. Outer and middle toes equal. No decided crests or ruffs. Small; length 10 inches or less . . . . . *Tachybaptes*

Bill stout, epignathous, obtuse. Nostrils broadly oval. Loral bare strip broad. Frontal feathers bristly. Tarsus not three-fourths the middle toe. Semipalmation of toes extensive. Lobe of hallux moderate. No decided crests or ruffs . . . . . *Podilymbus* 336

334. ÆCHMOPHORUS. (Gr. *αἰχμή, aichme*, a spear; *φορός, phorus*, bearing.) SPEAR-BILL GREBES. Bill very long, exceeding the head, straight or slightly recurved, very slender and acute; culmen straight or slightly concave; commissure about straight, or slightly sinuate at base; under outline concave at base, without protuberance at symphysis. Bare loral space extremely narrow. Wings comparatively long, with much attenuated outer primaries. Legs long; tarsus not shorter than bill, as long as middle toe and claw; basal webbing of toes slight. Size large; neck very long; body slender. Crest and ruffs inconspicuous, not specially colored in our species. One species, western, of which two varieties may usually be recognized by the following characters:

Analysis of Varieties.

Large; length (extreme) about 29.00 inches; wing about 8.00; bill and tarsus each about 3.00. Bill equal to tarsus, straight, mostly dark olivaceous, brighter yellowish at tip and along cutting edges. Under outline of bill straight from base to the slight angle, gonys thence straight to tip. Lores ashy-gray. *occidentalis* 845

Small: length about 22.00 inches; wing about 7.00; bill 2.25; tarsus 2.75. Bill shorter than tarsus, slightly recurved, under outline almost regularly convex from base to tip, with barely appreciable angle. Lores pure white . . . . . *clarki* 846

845. Æ. occidentalis. (Lat. *occidentalis*, western.) WESTERN GREBE. Bill obscurely olivaceous, brighter along edges and at tip. Iris orange-red, pink or carmine, with a white ring. Hard parts of palate like bill; soft parts purplish or lavender. Outer side and sole of foot blackish, rest dull olivaceous, more yellowish on webs. Forehead and lores dark silvery-ash. A short occipital crest and puffy cheeks, but neither bright-colored, agreeing with white and dark colors of the respective parts. Top of head and line down back of neck sooty-blackish, changing on upper parts into a lighter, more brownish black, the feathers of the back with grayish margins. Primaries mostly dark chocolate-brown, with white bases; their shafts white at base. Secondaries mostly white, but more or fewer of them dark on most or all of the outer webs. Sides under the wings washed with a pale shade of the color of the back. Lining of wings and whole under parts from the bill pure white, with satiny gloss. Length 24.00–29.00; extent 40.00 or thereabouts; wing about 8.00; bill, tarsus, middle toe and

claw, all about 3.00; gape of bill 3.60; height at base 0.50. Western U. S., common. As here described, the bird is given in its purest character; but it grades in size directly into the next, and some of the larger individuals have a mostly yellow and somewhat recurved bill, with white lores.

846. **Æ. o. clark'i.** (To J. H. Clark.) CLARK'S GREBE. Bill about as long as head, shorter than tarsus, slightly recurved, extremely slender and acute; culmen a little concave; under outline almost one unbroken curve from base to tip. Adult in breeding plumage: Under mandible, and tip and cutting edges of the upper, chrome-yellow, in marked contrast to black of culmen. Loral bare strip leaden-blue. Crown, occiput, and hind-neck deep grayish-black; almost pure black on the hind-head, fading gradually along the neck into the lighter blackish-gray of the upper parts generally. Lores broadly pure white, as are the entire under parts, with a sharp line of demarcation along the sides of the head and neck. A decided occipital crest, the feathers about an inch long and quite filiform, but not colored apart from the general coloration. No decided ruffs — no colored ruffs at all; but the white feathers of the sides of the head behind and across the throat are longer and fuller than elsewhere — about as in *griseigena*. Wings and general coloration (except the white lores) exactly as in *occidentalis*. Winter dress not materially different. Dimensions: length about 22.00 inches; extent 28.50; wing 7.00; bill along culmen 2.30; along gape 2.75; height at nostrils 0.40; tarsus and middle toe with claw, each about 2.75. Thence grading up to *occidentalis*. With only extremes before us of the two varieties, one might well consider them distinct species; but other specimens show the intergradation; we frequently find specimens as small as typical *clarki*, and with equally slender bill, yet with the color of the bill wholly olivaceous and the lores ashy, as in typical *occidentalis*. Western U. S.

335. **PODICIPES.** (Lat. *podex*, gen. *podicis*, the rump; *pes*, foot.) GREBES. Bill moderately stout, usually more or less compressed, equalling or shorter than the head or tarsus. Tarsus obviously shorter than the middle toe and claw. Outer lateral toe a little longer than the middle. Head in the breeding season with lengthened colored crests or ruffs, or both.

NOTE. — Believing *P. cristatus* may have been hastily eliminated from our fauna, I analyze and describe it with the rest, without number assigned.

Analysis of Species (adults).

Large: length over 15 inches. Bill more or less nearly equalling the head or tarsus in length.
- Crests, and especially ruffs, long and conspicuous. Neck without red or gray in front; under parts pure silky-white. Tarsus averaging equal to the middle toe without its claw . . . . . *cristatus*
- Crests moderate; ruffs inconspicuous. Neck with red or gray in front; under parts watered with dusky (sometimes but slightly). Tarsus averaging less than the middle toe and claw . . *holbœlli* 847

Small: length under 15 inches. Bill much shorter than head; little over half the tarsus.
- Bill compressed, higher than broad at the nostrils. Crests and ruffs very conspicuous: neck red in front . . . . . *cornutus* 848
- Bill depressed, broader than high at the nostrils. Crests in form of auricular tufts; neck black in front . . . . . *auritus* 849, or *californicus* 850

P. crista'tus. (Lat. *cristatus*, crested.) CRESTED GREBE. Adult, breeding plumage: Crown and long occipital crests glossy black; end of ruff the same, the rest reddish-brown, fading into silky-white of throat and sides of head. Neck behind and upper parts dark brown, the feathers with gray margins. Primaries chocolate-brown, with black shafts, the tips of the inner ones white, as are all the secondaries and tertiaries, excepting a little of the outer webs of the former; greater wing-coverts white on inner webs. Under parts pure silky white, without a trace of dusky mottling, the sides of the neck and body tinged with reddish, and on the flanks mixed with dusky, where the feathers have dark shaft-lines. Length about 24.00; extent 33.00; wing 7.00; bill 2.00, the gape 2.70; tarsus 2.50. Europe, etc. N. Am. ?

847. **P. griseige'na holbœlli.** (Low Lat. *griseus*, gray; *gena*, cheeks. To C. Holböll.) AMERICAN RED-NECKED GREBE. Adult, breeding plumage: Crests short, and ruffs scarcely apparent. Iris carmine. Bill black, the tomia of upper mandible at base and most of lower mandible yellowish. Crown and occiput glossy greenish-black; back of neck the same, less intense, and upper parts generally the same, with grayish edgings of the feathers. Wing-coverts and

primaries uniform chocolate-brown, the shafts of the latter black. Secondaries white, mostly with black shafts and brownish tips. Lining of wings and axillars white. A broad patch of silvery-ash on the throat, extending around on sides of head, whitening along line of juncture with the black of the crown. Neck, except the dorsal line, deep brownish-red, which extends diluted some distance on the breast. Under parts silky-white, with a shade of silvery-ash, each feather having a dark shaft-line and terminal spot, producing a peculiar dappled appearance. Winter plumage, and young: Crests scarcely appreciable. Bill mostly yellowish, the ridge more or less dusky. Red of the neck replaced by brownish-ash of variable shade, from quite dark to whitish. Ash of throat and sides of head replaced by pure white. Under parts ashy-white, the mottling not so conspicuous as in summer. Dimensions: Length about 19.00; extent 32.00; wing 7.60; bill along culmen 1.90–2.40, along gape 2.40–3.10; height at nostrils 0.55; tarsus 2.50; middle toe and claw 2.85. This bird could only be confounded with *cristatus* in immature dress: it is smaller, stouter, more thick-set, with stouter bill, nebulated under plumage, less white on the wing, and usually has rather shorter tarsi, — only about four-fifths the middle toe and claw, instead of about equal to the middle toe alone, as in *cristatus*. The American bird is a larger variety of the European, the bill, especially, disproportionately longer, differently shaped and colored; tarsus longer, both absolutely and relatively to length of toes. N. Am. at large and Greenland; common in the U. S. in winter, breeding northerly. Eggs 2.10 to 2.35 × 1.25 to 1.45, rough, whitish, either inclining to pale greenish or with buffy discoloration, of the narrow-elongate shape usual in this family.

Obs. Specimens more like the typical *griseigena* from the N. W. coast.

848. P. cornu'tus. (Lat. *cornutus*, horned.) Horned Grebe. Adult, breeding plumage: Bill black, tipped with yellow. Feet dusky externally, internally yellowish. Iris carmine, with a fine white ring. A brownish-yellow stripe over eye, widening behind and deepening in color at the ends of the long crests, and being dark chestnut between eye and bill. Crown, chin, and the very full ruff glossy greenish-black. Upper parts brownish-black, with paler edges of the feathers. Primaries rather light chocolate-brown, with black shafts, except at the base. Secondaries white. Neck all round, except stripe down behind, and sides of the body, rich dark brownish-red or purplish wine-red, mixed with dusky on the flanks. Under parts pure silky-white. Winter plumage, and young: Bill dusky, much of the under mandible bluish or yellowish-white. Indications of crests and ruff in the length and fulness of the feathers of the parts. Crown and neck behind, and sides of the body, sooty-blackish. Other upper parts and the wings as in the adult. Chin, throat, and sides of head, pure white, this color nearly encircling the nape. Neck in front and lower belly lightly washed with ashy-gray. Under parts as before. Newly-fledged young are curiously striped on the head with rufous, dusky, and white. Dimensions: length about 14.00 inches; extent 24.00; wing 5.75; tarsus 1.75; middle toe and claw 2.10; bill along culmen about 0.90, along gape 1.30; its height at the nostrils 0.30, its width there 0.25. Bill compressed, tapering, with considerably curved culmen, — quite different from the broad depressed bill with straight tip and much ascending gonys of *P. auritus*. It varies much in size, even among equally adult examples; in the young it is always smaller and weaker than in the old. Black, yellow-tipped in the old, we find it variously lighter in the young, — usually dusky on the ridge, elsewhere tinged with olivaceous, yellowish, or even orange or extensively bluish-white. In breeding plumage this bird is conspicuously different from any other; but the young are much like those of *P. auritus*, requiring careful discrimination. N. Am. at large, abundant, and generally diffused. Eggs laid on soaking or floating beds of decayed reeds, white or slightly shaded, elliptical, 1.70 × 1.20.

849. P. auri'tus. (Lat. *auritus*, eared.) European Eared Grebe. Like the next to be described, excepting more white on the wing; inner four primaries entirely white, all the rest more or less white, secondaries all entirely white. Only N. Am. as occurring in Greenland (?).

850. **P. a. califor'nicus.** American Eared Grebe. Adult, breeding plumage: Bill shorter than head, rather stout at base, much depressed, broader than high at the nostrils, tip acute, not decurved, gonys straight, ascending, culmen a little concave basally, nearly straight terminally. Tarsus about equal to middle toe without its claw. Bill entirely black. Feet dull olivaceous, blackish outside and on sole. Eye scarlet. Eyelid orange. Conspicuous long auricular tufts, golden-brown or tawny, finely displayed upon a black ground. Crown, chin, and neck all round, black. All the primaries entirely chocolate-brown, with usually a wash of dull reddish-brown externally. Secondaries white, but the bases of all, and a considerable part of the two outer ones, dusky; their shafts mostly all dusky. Sides deep purplish-brown or wine-red; this color washed across the breast, behind the black of the neck, and also across the anal region. Under parts silky-white, the abdomen grayish. Young: Bill shaped generally as in the adult, but smaller, with less firm outlines, so that its distinctive shape is somewhat obscured. Little or no trace of the auricular tufts. Crown, sides of head, and neck all around, sooty-grayish, paler and more ashy on the foreneck. Upper parts rather lighter and duller colored than in the adults. Primaries as in the adults, but without the reddish tinge; a few of the innermost ones sometimes white-tipped. Sides under the wings washed with a lighter shade of the color of the back; lower belly grayish. Dimensions: length 12 to 14 inches, usually 13 or less; extent 21.50–24.00; wing 4.75–5.25; bill 1.00 or less; along gape 1.25; height at nostril 0.22; width there 0.26; tarsus 1.60; middle toe and claw 1.95. While the breeding plumages of *P. cornutus* and the present species are widely different, there is much similarity between the young and winter dress of the two species. As a rule, *auritus* is smaller; even traces of ruffs are less appreciable; the fore neck is scarcely lighter than the hind neck; the back is rather deeper colored and more uniform. The shape and proportions of the bill, however, furnish the most reliable characters. Western N. Am., the commonest species of grebe breeding in the pools west of the Mississippi; E. to Illinois. Eggs not distinguishable from those of *P. cornutus*.

851. **P. domi'nicus.** (Of St. Domingo.) St. Domingo Grebe. Representing a genus or subgenus apart from the foregoing (*Tachybaptes*). Bill very short, much less than the head, scarcely over half the tarsus; stout, little compressed, rather obtuse. Lateral outlines nearly straight; culmen slightly concave at the nostrils, elsewhere convex; commissure straight, except a little sinuation at base; under outline straight to angle, gonys thence straight to tip, the angle well defined. Wings short, and with abrupt attenuation of the outer primaries. Tarsus stout, little over three-fourths the middle toe and claw; outer lateral about equal to the middle toe. Size very small; body full; neck short; no decided crests or ruffs. Adult: Crown and occiput deep glossy steel-blue. Sides of head and neck all around dark ashy-gray, darkest behind, where tinged with bluish. Chin varied with ashy and white. Upper parts brownish-black, with glossy-greenish reflections. Primaries chocolate-brown, the greater portion of the inner vanes of all, and nearly all of the inner four or five, together with all the secondaries, pure white. Under parts silky-white, thickly mottled with dusky. Upper mandible dusky, the lower mostly yellowish. Dimensions: length about 9.50; extent 16.00; wing 3.60; bill along culmen 0.70; along gape 1.00; tarsus 1.25; middle toe and claw 1.75. Warmer parts of America, N. to the Rio Grande of Texas.

336. **PODILYM'BUS.** (*Podicipes*+*Colymbus*.) Thick-billed Grebes. Bill shorter than head, stoutest in the family, compressed, with obtuse and hooked tip; culmen about straight to the nostrils, thence declinato-convex; gonys regularly convex without decided angle; commissure slightly sinuate at base, then straight, then much deflected. Upper mandible covered with soft skin to the nostrils, between which are two fossæ, the anterior shallow, oblong, the other deep, triangular, separated from the bare loral space by an intervening ridge. Nostrils broadly oval, far anterior. No crests or ruffs, but shafts of frontal feathers prolonged into bristles. Eyelids peculiarly thickened. Outer three or four primaries abruptly sinuate near

the end. Tarsus much abbreviated, comparatively stout, about three-fourths as long as middle toe and claw. Middle and outer toes nearly equal. Basal semipalmation of toes more extensive than in *Podicipes*. Lobe of hind toe moderate.

852. P. podi'cipes. (For *podicipes*, see above.) Pied-billed Grebe. Dabchick. Dipper. Diedapper. Waterwitch. Adult, breeding plumage: Bill light dull bluish, or bluish-white, dusky on ridge or at tip, encircled with a broad black band. Iris brown and white; eyelids white. Feet greenish-black outside, leaden-gray inside. Frontal and coronal bristles black. Crown, occiput, and neck behind, grayish-black, the feathers with slightly lighter edges. Sides of head and neck brownish-gray. A broad black throat-patch, extending on sides of lower mandible. Upper parts brownish-black, the feathers with scarcely lighter edges. Primaries and secondaries chocolate-brown, the latter frequently with a white area on the inner webs. Under parts ashy, washed over with silvery-gray, thickly mottled with dusky; these dark spots most numerous and evident on the sides. Lower belly nearly uniformly dusky. Winter plumage: Bill light dull yellowish, without a dark band, more or less dusky on the ridge. No gular patch. Crown and occiput dusky brown. Upper parts with more evident pale edgings of the feathers than in summer. Neck, breast, and sides, light brown, darker posteriorly, where more or less conspicuously mottled with dusky. Under parts otherwise pure silky-white, immaculate; lower belly grayish. Young-of-the-year: White gular patch invaded by streaks of the brownish of the head, and the latter much streaked with white. Dimensions: length about 13.00; extent 24.00; wing about 5.00; bill along culmen 0.75; along gape 1.20; height at nostrils 0.40; width 0.25; tarsus 1.50; middle toe and claw 2.15. Varies greatly in size. Inhabits the greater part of S. and C. Am. and all temperate N. Am.; the most abundant species of the family in Eastern U. S.

63. Family ALCIDÆ: Auks.

Feet palmate, three-toed (hallux wanting). Tarsi reticulate or partly scutellate. Tibiotarsal joint naked. Claws ordinary. Bill of wholly indeterminate shape, often much as in *Colymbidæ* or *Podicipedidæ;* often curiously shaped, with various ridges, furrows, or horny protuberances. Tail perfect, of few feathers. Lores completely feathered. Nostrils wholly variable in shape and position, naked or feathered. Legs very variable. Coloration variable; head often with long curly crests. No tibial apophysis. Usually (always?) an anconal sesamoid, sometimes double. Carotids usually double (single in *Alle*). Cœca coli present; ambiens muscle present, accessory semitendinosus absent; oil-gland tufted. Palatal structure schizognathous; nasal schizorhinal. Nature altricial and ptilopædic. Eggs few or single, plain or variegated. The numerous species confined to the Northern Hemisphere.

Birds of this family will be immediately recognized by the foregoing circumstances, taken in connection with general pygopodous characters. Agreeing closely in essential respects, they differ among themselves to a remarkable degree in the form of the bill, with every genus and almost every species; this organ frequently assuming an odd shape, developing horny processes, showing various ridges and furrows, or being brilliantly colored. It is the rule that any *soft* part that may be observed on the bill will finally become hard, or form an outgrowth, or both; and such processes, in some cases at least, are temporary, appearing only during the breeding season.

The last sentence, reprinted as it stands in the original edition of the Key (1872) hints at the extraordinary changes undergone by the bill in several genera of *Alcidæ*, so ably elucidated in 1877 and 1879 by L. Bureau, who showed that in many species parts of the horny covering of the bill are regularly shed or *moulted*, in a manner analogous to the casting of deer's antlers, quite as shown by R. Ridgway in the case of our White Pelican, which drops the "centre-board." In the Common Puffin, for example, no fewer than *nine* pieces of the bill fall off

separately, after the breeding season, to be renewed again from the soft basement membrane. The absence, *in winter*, of the horny plate at the angle of the mouth of *Simorhynchus cristatellus*, had been noted (Key, p. 342), as well as the presence or absence of the horn of *Ceratorhina ;* but we had no knowledge of the process by which the change was effected, prior to Bureau's studies. In the Puffins there is also a moult of the excrescences upon the eyelids, and a shrivelling of the colored rosette at the corner of the mouth.

The Auks are confined to the Northern Hemisphere. Some representatives have been found as far north as explorers have penetrated. The great majority live in more temperate latitudes. A more or less complete migration takes place with most species, which stray southward, sometimes to a considerable distance, in the autumn, and return north again to breed in the spring. A few species appear nearly stationary. The most southern recorded habitat of any member of the family is about latitude 21° N., on the Pacific coast of North America, but this is rather exceptional. The species are very unequally divided between the two oceans. The Atlantic has but few representatives compared with the Pacific. On the northern coasts of the latter the family reaches its highest development ; the greatest number of species, of the most diversified forms, are found there, though the number of individuals of any species does not surpass that of several Atlantic species. Comparatively few species are common to both oceans. All the members of the family are exclusively marine. They are decidedly gregarious, particularly in the breeding season, when some species congregate in countless numbers. Usually one, often two, rarely three eggs are laid, either upon the bare rock or ground, or in crevices between or under rocks, or in burrows

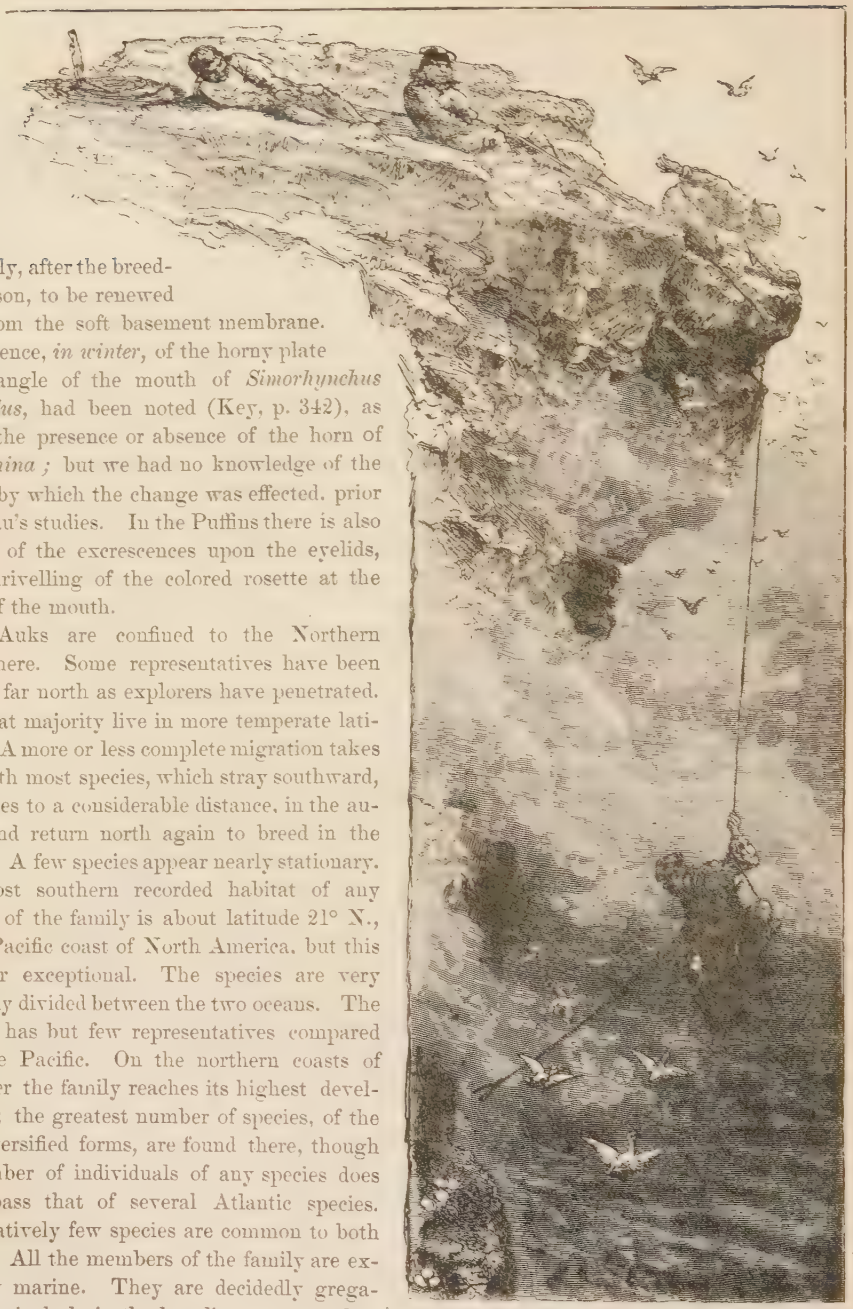

FIG. 531. — Egging in Alaska on cliffs inhabited by Kittiwakes (p. 748), Auks, etc. (Designed by H. W. Elliott. From Harper Brothers.)

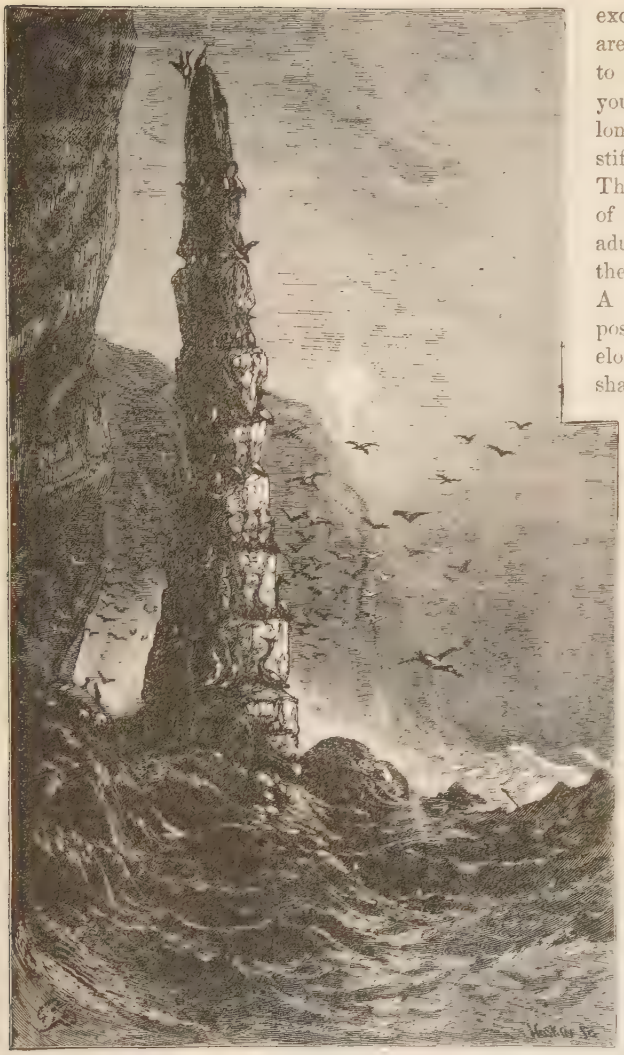

FIG. 532. — A needle rock tenanted by Cormorants (p. 728, No. 757), Auks, etc. (Designed by H. W. Elliott. From Harper Brothers.)

excavated for the purpose. Auks are all altrices, and are believed to be chiefly monogamous. The young are at first covered with long soft woolly down; rarely stiffish hairs appear on some parts. The moult is double. The young of the year usually differ from the adults; the latter usually differ in their summer and winter plumages. A very prevalent feature is the possession of crests or plumes, or elongated feathers of a peculiar shape on the sides of the head.

All the species walk badly; some scarcely walk at all. The position of the legs with reference to the axis of the body necessitates an upright position when standing. The birds appear to rest on their rumps, with the feet extended horizontally before them, most of the tarsus touching the ground. The Puffins, however, and a few others, stand well on their feet. All the species but one fly well, with rapid vigorous motion of the wings, in a straight, firm, well-sustained course. All progress on or under the water with the utmost facility. They are very silent birds; the voice is rough and harsh; the notes are monotoned. They feed exclusively upon animal substances procured from the water.

The family is divisible into two subfamilies according to the feathering of the nostrils and other characters.

Analysis of Subfamilies and Genera

PHALERIDINÆ. Nostrils naked, remote from feathers. Bill of variable shape, always compressed, higher than wide, as far as known appendaged with deciduous elements. Head nearly always crested. No great seasonal changes of plumage.

Eyelids with deciduous appendages. No crests. Bill extremely high and thin; culmen with one curve; both mandibles grooved. A rosette at angle of mouth. Covering of bill moulted in 7-9 pieces. Inner lateral claw enlarged. Tarsus scutellate in front . . . . . *Fratercula* 337

Eyelids simple. Long lateral crests. Bill extremely high and thin; culmen with two curves, upper mandible grooved, under smooth. A rosette at angle of mouth. Covering of bill moulted in 7 pieces. Inner lateral claw enlarged. Tarsus scutellate in front . . . . . *Lunda* 338

Eyelids simple. Lateral crests. Bill with a deciduous horn at base of upper mandible. No rosette

Neither mandible grooved. Covering of bill moulted in 2 pieces. Inner lateral claw normal. Tarsus scutellate in front . . . . . *Ceratorhina* 339
Eyelids simple. Variously crested. Bill of indeterminate shape, various parts moulted in 1-7 pieces. No soft rosette. Inner claw normal. Tarsus reticulate . . . . . *Simorhynchus* 340
Eyelids simple. Not crested? Bill acute; upper mandible striate; no moult of bill known. No rosette. Inner claw normal. Tarsus reticulate . . . . . *Ptychorhamphus* 341

ALCINÆ. Nostrils more or less completely feathered. Bill of variable shape, as far as known not appendaged with deciduous elements. Head not crested (except one species). Seasonal changes of plumage usually marked.
Bill elongate, more or less slender, without vertical grooves.
Nostrils nearly circular, incompletely feathered. Bill short and stout for this group. Tarsus scarcely compressed, scutellate in front . . . . . *Alle* 342
Nostrils broadly oval, incompletely feathered. Bill much compressed. Tail nearly even. Tarsus extremely compressed, scutellate in front and internally . . . . . *Synthliborhamphus* 343
Nostrils oval, feathered. Bill very small, slender, acute. Tarsus reticulate . *Brachyrhamphus* 344
Nostrils narrow, feathered. Bill about equal to tarsus. Tarsus reticulate . . . . . *Uria* 345
Nostrils narrow, densely feathered. Bill longer than tarsus. Tarsus scutellate in front *Lomvia* 346
Bill elongate, stout, high, narrow, vertically grooved. Nostrils linear, densely feathered.
Wings fully developed, fit for flight . . . . . *Utamania* 347
Wings reduced in size, unfit for flight . . . . . *Alca* 348

OBS. Many additional characters of these remarkable genera are given under their respective heads.

76. Subfamily PHALERIDINÆ: Parrot Auks, etc.

Characters as above. This subfamily contains a number of curious birds of the Auk family for which there is no single English name. With one exception (that of the Common Puffin or Sea Parrot of the Atlantic) all are confined to North Pacific and Polar waters. Without known exception (but qu. *Ptychorhamphus?*) all these birds have the bill appendaged with deciduous elements, which is not the case with the *Alcinæ* proper; but the subfamily is not very sharply distinguished from *Alcinæ*, such forms as *Ptychorhamphus* and *Alle* being connecting links. The genera *Fratercula* and *Lunda* are together so different from the rest that some authors separate them as a family *Mormonidæ;* but this seems scarcely advisable.

337. **FRATER'CULA**. (Dimin. of *frater*, a brother: what application?) SEA PARROTS. MASKING PUFFINS: the grotesque bill being likened to the comic mask of revellers at a carnival, and being as it were put on for the nuptial festivities, and afterward removed. Bill about as long as head, about as high as long, extremely compressed, with nearly vertical sides, its lateral profile somewhat triangular, its depth at base equal to that of the head; culmen beginning on a level with the forehead, thence curving downward with regular convexity to the overhanging tip, its ridge sharp and unbroken throughout; commissure straight and horizontal to the decurved tip; gonys sharp, ascending, gently sinuous. Terminal portions of both mandibles hard, horny, and persistent, depressed with several oblique curved grooves, convex forward. Basal portion of upper mandible forming a narrow obtuse-angled triangular

FIG. 533. — Head of Sea Parrot (*F. arctica*), nat. size. (Ad nat. del. E. C.)

space, or nasal fossa, its short base horizontal, its long sides rising and sloping backward to meet at an acute angle at base of culmen; the linear nostrils horizontal, close to commissure at base of this space, which in winter is naked and membranous, in summer covered with a symmetrical horny "saddle" sheathing the nasal fossa; with a basal raised "collar" surrounding base of upper mandible, through numerous perforations of which protrude rudimentary feathers; with a small narrow horizontal horny strip on each side below nostrils; with usually, also, a long, narrow, obliquely vertical strip bounding the triangular space anterior. Basal portion of under mandible contracted and membranous in winter, in summer with a symmetrical horny "shoe" which carries the line of the gonys downward and backward to a point, and a narrow horny strip along base. These deciduous elements thus forming three symmetrical pieces, surrounding the bill, and three or two pairs of lateral pieces; in all, 9 or 7 pieces (9 in *arctica* and *glacialis*, 7 in *corniculata*) which are regularly moulted. Angle of mouth with a rosette of naked skin, festooned in summer, shrunken in winter. Eyelids surmounted above by a triangular, obtuse or acute, below by a horizontal, lengthened, callosity. No crests on head, but a furrow in plumage behind eye. Wings not peculiar. Tail rounded, but central feathers shorter than the next, contained about 2½ times in length of wing, 16-feathered. Tarsus very short, only equal to inner toe without claw, stout, little compressed, reticulate except for a small space in front, which is scutellate. Outer toe about equal to the middle; its claw shorter than the middle claw, both slightly curved, not very acute, upright; middle claw dilated on inner edge; inner claw enlarged, curved to a semicircle, very acute, usually lying horizontal. Sexes alike; seasonal changes of plumage slight, those connected with the moult of the bill very great. Egg single, white or scarcely marked, laid in rocky crevices or burrows in ground.

Analysis of Species.

Excrescence of upper eyelid forming a slender acute horn. Height of bill much greater than length of commissure. Black of throat reaching bill. . . . . *corniculata* 853

Excrescence of upper eyelid forming an obtuse process. Black of throat not reaching bill.

Culmen moderately convex, its chord about 2.00; its arc 2.10; bill under 1.50 deep at base. Wing under 7.00 . . . . . *arctica* 854

Culmen very convex, its chord about 2.40; its arc 2.60; bill over 1.50 deep at base. Wing 7.00 or more . . . . . *glacialis* 855

853. F. cornicula'ta. (Lat. *corniculata*, having a little horn (over the eye). Fig. 534.) Horned Masking Puffin. Adult in summer: Appendage of the upper eyelid produced into a long, slender, acute, upright horn; that of lower eyelid linear-obtuse, horizontal. Bill very large, especially high for its length, its height about equal to chord of culmen exclusive of the basal collar, much greater than length of gape; base of culmen and point of gonys both produced far backward, giving a very convex outline of feathers alongside the bill; sides of bill not distinctly divided into nasal compartment and grooved portion, nearly smooth, with only three short shallow grooves; culmen very convex, almost the sextant of a circle; tip of upper mandible much hooked; rictus short, that portion in advance of the basal rim of upper mandible only about as long as upper mandible is deep; outline of gonys sinuate, at first convex, then more ascending, with slight concavity; chord of gonys nearly as long as that of upper mandible, exclusive of the basal rim or collar. Form otherwise not peculiar in the genus. Crown of head grayish-black, narrowing to a point at base of culmen. Sides of head white; the postocular furrow and sides of lower jaw ashy. A distinct narrow line of white along edge of fore-arm. Entire upper parts glossy blue-black; a sootier shade of black encircling the fore-neck, running forward on throat to bill. Other under parts white, except a few elongated blackish feathers on sides of flanks. Lining of wings pearly-ash. Bill entirely vermilion-red, even the basal collar; edges of eyelids red; excrescences of eyelids bluish-gray; iris brown; feet orange-red, the webs tinged with vermilion; claws brownish-black; rosette of mouth bright yellow-orange. Length 14.50; extent 24.50; wing 7.25; tail 2.75;

tarsus 1.10; middle toe and claw 2.00; outer do. 1.90; inner do. 1.35; chord of culmen 2.00; curve 2.25; gape, from basal collar to tip, 1.20; chord of gonys 1.75; depth of bill at base 1.80; greatest width 0.60; nostril 0.40; horn over eye 0.35. In winter: The moult of the bill not known; supposed with good reason to shed 3 symmetrical pieces and two pairs of pieces, in all 7, namely, the collar at base of upper mandible; the saddle of nasal fossa; the shoe of under mandible; the pair of sub-nasal strips; the pair of mandibular strips; if so, all the same as in *F. arctica*, excepting the pre-nasal strips. The processes of the eyelids fall; the colored ring round eye pales; the rosette of mouth shrivels and pales; feet yellow; the denuded membranous part of bill doubtless blackish. In any state, the species is easily recognized by extension of the black collar to the bill. N. Pacific, both coasts, and adjoining polar seas; not known in N. Atlantic; S. to Sitka at least. Economy in all respects that of the better known species. The single egg seen is dead white, rough, 2.75 × 1.75.

854. F. arctica. (Lat. *arctica*, arctic. Fig. 533.) Common Puffin. Sea Parrot. Adult in summer: Appendage of upper eyelid upright, obtusely triangular; of lower eyelid linear, obtuse, horizontal. Bill moderately large, with moderate convexity of culmen, its height less than chord of culmen, little more than from posterior border of nostril to tip; base of culmen and point of gonys not produced far backward, leaving but moderately convex outline of feathers along side of bill; sides of bill distinctly divided into an anterior, hard, horny, deeply grooved portion, differently colored from the smooth basal portion; rictus long, that portion in advance of the basal rim of upper mandible much longer than upper mandible is deep; outline of under mandible regularly curved from base to tip; chord of gonys much shorter than that of culmen. Crown of head grayish-black, sharply defined against color of sides of head, separated by a slight ashy cervical collar from the dark color of the upper parts. Sides of head, with chin and throat, ashy-white, nearly white between eyes and bill, with a dark ashy patch on side of throat. Upper parts glossy blue-black, continuous with a broad collar around the neck in front, not extending to the bill. A narrow line of white along border of fore-arm. Under parts from the neck pure white, the long feathers of the sides and flanks blackish. Under surface of wings pearly-gray; inner webs of primaries and secondaries grayish-brown, the shafts brown, with black ends and whitish bases. Iris brown. Eyelids vermilion-red, the excrescences grayish-blue. Basal collar of bill and first ridge dull yellowish; nasal saddle and corresponding shoe of lower mandible grayish-blue; rest of bill vermilion-red, the tip of the lower mandible and two terminal grooves often yellowish; rosette of mouth orange-yellow; feet coral or vermilion-red;

Fig. 534. — Left, Horned Puffin; right, Tufted Puffin. (Drawn by H. W. Elliott. From Harper Brothers.)

claws black. Length 13.50; extent 24.00; wing 6.50; tail 2.25; tarsus 1.00; middle toe alone 1.40, its claw 0.40; outer do. 1.40, its claw 0.30; inner do. 1.00, its claw 0.40 (its chord — the curve more); chord of culmen 2.00, its arc 2.10, the ordinate 0.30; depth of bill 1.40; gape 1.25; gonys 1.45; greatest width of bill (at base of nostrils) 0.60; nostrils 0.35. ♀ averaging less than ♂. In winter: No colored eye-ring nor appendages of eyelids. Rosette of mouth shrunken and pale. Feet orange, not red. Face blackish around eye, the ashy-white obscured with dusky. Basal parts of bill membranous and blackish, and whole base of bill contracted, the point of the gonys cut off. The following pieces have been shed: 1, the basal rim or collar; 2, the nasal case or saddle; 3, the mandibular case or shoe; 4, 5, the strips at base of mandible, one on each side; 6, 7, the subnasal strips, one on each side; 8, 9, the prenasal strips, one on each side (3 symmetrical pieces, 3 paired pieces, 9 in all). Young, first fall and winter: Resemble the adults in winter, but bill still weaker and less developed; the plumage is the same, with blackish face. This long kept us in ignorance of the moult of the bill, the adults in winter being mistaken for young birds by all authors till Bureau explained the case. Inhabits the coasts and islands of the N. Atlantic, breeding in Iceland, Southern Greenland, Labrador, Newfoundland and S. to Bay of Fundy; rare in the N. Pacific (Pallas), where chiefly replaced by *F. corniculata;* replaced on most of the European coast by a smaller weaker-billed variety, and in Polar Seas by the larger stouter-billed *F. glacialis.* In winter, ranging or driven south irregularly along most of the U. S.; not regular beyond New England. The moult of the bill as well as of the plumage occurs in August and September, when the birds are unable to fly for a period, and many perish if caught at sea in storms at this time. Nest by thousands on coasts and islands, burrowing in the ground like rabbits, to arm's length or more. The single egg is laid late in June and in July, on a slight grassy nest at the end of the burrow; in shape rounded ovate, with greatest diameter nearly at the middle; average size 2.50 × 1.75; shell granular, white or brownish-white, colorless or marked with obsolete spots, dots, and scratches of pale purplish, sometimes with a few splashes of pale yellowish-brown. Nestlings are covered with blackish down, whitish below from the breast.

855. **F. a. glacia'lis.** (Lat. *glacialis*, icy.) Large-billed Puffin. Specific character of *F. arctica;* size greater, the bill especially larger, and differently shaped. Protuberance of upper eyelid higher and sharper. Bill very deep, rising high on forehead, with very convex culmen, dropping nearly perpendicularly at end. Four grooves of upper and three of lower, distinct; gonys quite convex. Length 14.50; extent 26.00; wing 7.25; tail 2.25; tarsus 1.20; middle toe and claw 1.90, outer do. 1.90, inner do. 1.45; chord of culmen 2.40, its arc 2.60, the ordinate 0.45; depth of bill at base 1.70; gape 1.50; gonys 1.60; greatest width of bill 0.65; nasal slit 0.45. Polar Seas; Spitzbergen; N. Greenland. *Not* authentic as occurring in the U. S. The seasonal changes are in all respects the same as those of *F. arctica.*

338. **LUNDA.** (Vox barb.) Tufted Masking Puffin. Generic character of *Fratercula*, excepting crest, eyelids, and details of bill. A long tuft of feathers on each side of head. Eyelids not appendaged. Nostrils very small, linear, marginal. Upper mandible divided into distinct but not differently colored compartments; its base with a deciduous raised rim or collar, perforated for the passage of feathers as in *Fratercula*, but this collar not so prominent, and the deciduous smooth basal saddle not so distinctly separated from the ridged part of the bill beyond, where are three well marked, widely separated curved grooves, concave forward (the reverse of *Fratercula*). Culmen arched in two separate curves, the basal one surmounted by a prominent widened ridge-pole, ending abruptly, the terminal one sharp, strongly convex to the hooked tip of the bill. Lower mandible with the sides perfectly smooth throughout, the outline of gonys at first descending, then rounding upward and thence about straight to tip of bill; the base of the mandible with a narrow deciduous border; ordinarily no evidence of the existence of the deciduous shoe of the lower mandible. The parts of the bill moulted are the

basal collar, the nasal saddle and pair of subnasal strips; the mandibular shoe and basal strip, three large symmetrical pieces and two pairs of small lateral pieces, in all seven. (Thus as in *F. arctica*, lacking only the pair of prenasal strips; thus exactly as supposed to be the case in *F. corniculata*. The loss of the pieces of the upper mandible makes the same difference in the bill as occurs in *F. arctica;* but the moult of the mandibular shoe effects less change in the appearance of the bill).

856. **L. cirra/ta**. (Lat. *cirrata*, having curly locks. Figs. 534, 535.) TUFTED PUFFIN. Adult in summer: Crests about 4 inches long, straw-yellow, some of the posterior feathers black at base; these bundles of silky, glossy feathers with very delicate shafts and loosened webs; they chiefly sprout from what corresponds to the furrow in the plumage of *F. arctica*. Face white, broadly of this color on sides of head to beyond eyes (as far as the crests), narrowly across forehead and chin, the bill being thus entirely surrounded by white. Crown between the crests, and entire upper parts, excepting the extreme forehead and a line along the forearm, glossy blue-black. Entire under parts, excepting extreme chin, and including sides of hind head and sides of neck, sooty brownish-black, more grayish on the belly, the lining of wings smoky-gray, the under tail-coverts quite black. Wings and tail black, their inner webs brownish-black, the shaft of the first primary whitish underneath near base. Bill, feet, and eye-ring vermilion-red; the basal parts of the bill when about to desquamate showing more yellowish or enamel color, or even showing the livid color of the subjacent membrane. Rosette of mouth yellow. Claws black. Eyes "brownish-yellow." Length 15.00–16.00; extent 27.00; wing 7.75; tail 2.75; tarsus 1.30; middle toe 2.00, its claw 0.50; outer do. 1.80, its claw 0.40; inner do. 1.25, its claw 0.50; greatest depth of bill 1.90; greatest width 0.90; chord of culmen 2.40, of which the terminal part is 1.40; gape about 1.90; gonys 1.60; greatest depth of upper mandible 1.15; nostrils 0.25. Adult in winter: Plumage as in summer; crests retained; iris "pale blue." Basal part of bill dark-colored, without the above-named deciduous

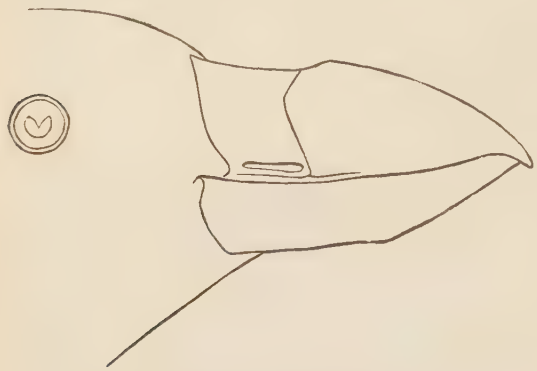

FIG. 535. — Bill of *young* Tufted Puffin, nat. size.

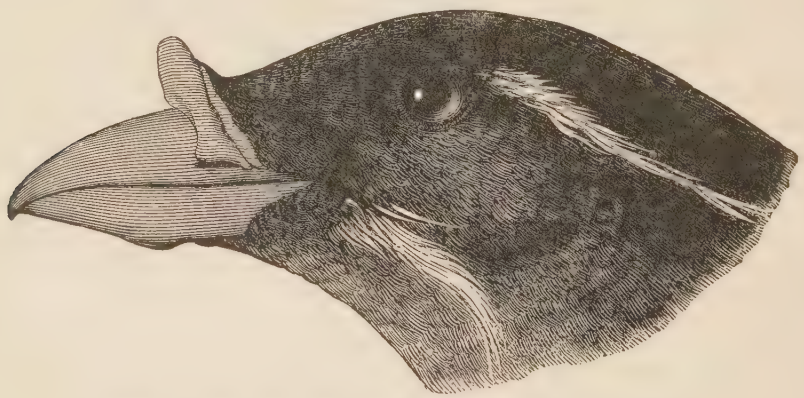

FIG. 536. — Horn-billed Auk, adult in summer, nat. size. (From Elliot.)

pieces; the change in upper mandible is decided, as in *F. arctica*, but the difference in the lower mandible is comparatively slight. In birds of the first spring the terminal portion of the bill may be smooth, like the under mandible, and the bill and feet rather orange-red than vermilion; at this time the face whitens and the crests sprout. Young: No crests, and no white about the face The bill like that of the adults in winter after the moult, saddled with soft dark-colored skin at base, but every way smaller, weaker, and quite smooth (" *Sagmatorhina lathami*," fig. 535,) and, like the feet, rather yellow or orange than red; the plumage entirely blackish above, sooty-brown below, the feathers of the belly and flanks whitish at the base; iris brown. Coasts and Islands of the N. Pacific, S. in winter on the American side to California; of casual occurrence on the Atlantic Coast to New England. General habits and economy of the common puffin; nesting similar. Egg single, rough, dead-white, but showing, besides frequent discolorations, obsolete shell-markings of pale purplish-gray; size from 2.65 to 2.85, by 1.92 to 2.00; broader and more capacious than that of *F. corniculata*, though no longer.

FIG. 537. — Horn-billed Auk, adult in winter, nat. size. (From Elliott.)

339. **CERATORHI'NA**. (Gr. *κέρας, κέρατος, keras, keratos*, a horn; *ῥίς, ῥινός, hris, hrinos*, the nose.) RHINOCEROS AUKS. Related to *Lunda* and *Fratercula;* no peculiarity of eyelids or inner claw; bill smooth; base of upper mandible with a large upright horn, and under mandible with an accessory horny piece lying between its rami; this piece and the horn deciduous, when base of upper mandible covered with a soft cere. Bill shorter than head, stout, deep at base, much compressed and rapidly tapering to acute decurved tip, sides erect, smooth, culmen very convex, gape gently curved, gonys nearly straight, with angle at symphysis. Nostrils short, linear, subbasal, marginal, impervious, at base of the horn or cere. Two series, postocular and maxillary, of lengthened, straight, stiffish lance-acute white feathers on each side of head. General form of *Fratercula*. Size large. One species.

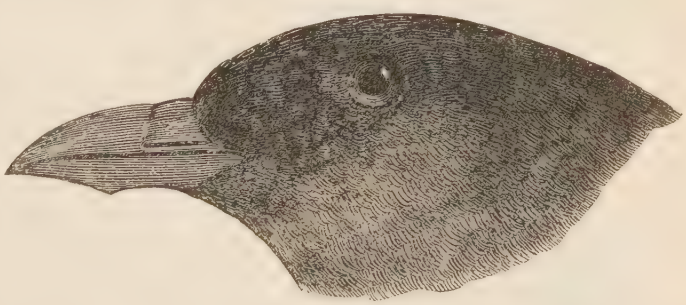

FIG. 538. — Horn-billed Auk, young, nat. size. (From Elliot.)

357. **C. monocera'ta**. (Gr. *μόνος, monos*, only, single; *κέρας, keras*, horn. Figs. 536, 537, 538.) UNICORN AUK. HORN-BILL AUK. Adults in summer: Bill orange-yellow. Culmen and base of upper mandible dusky; feet some yellow color, the tarsi behind and the soles blackish; claws black. The sharp feathers of the head white, about an inch long. Entire upper parts glossy blue-black; a line of white along edge of forearm. Sides of head and neck, of body along under the wings, with chin, throat, and fore-breast, clear grayish-ash, or pale bluish-

gray; under parts from the breast pure white, shading insensibly into the color of the sides and flanks. Inner webs of wing- and tail-feathers grayish-brown, paler toward base, the shafts of the primaries dull whitish at base. Length 15.50; extent 26.00; wing 7.25; tail 2.50; tarsus 1.20; middle toe and claw 1.85; outer do. 1.70; inner do. 1.40; chord of culmen without horn 1.00, with horn 1.40; gape 2.00; nostril to tip of horn 0.75; total depth of bill, including horn, 1.25. In winter: Plumage the same; iris white; no horn nor accessory piece under the bill, these being shed; place of horn occupied by a soft dark-colored basement membrane or cere ("*Sagmatorhina suckleyi*," Fig. 537). Young: Bill like that of adults in winter, lacking horn, but every way weaker, hardly more than half as large. Mostly dark-colored. No white feathers on side of head. White of under parts overlaid and marbled with dark-gray ends of the feathers; black of upper parts brownish. The first spring the horn grows, the accessory piece develops, and the plumage clears up. Nestlings are covered with smoky-brown down. Both coasts and islands of N. Pacific, to Lower California and Japan; not specially arctic; e. g., breeds on the Farallone Islands.

340. SIMORHYN'CHUS. (Gr. σιμός, *simos*, snub-nosed; ῥύγχος, *hrugchos*, beak.) SNUB-NOSED AUKS. Of moderate and very small size, and stocky shape. Head usually crested or with peculiar feathers. Bill of indeterminate shape, differing with each species, furnished with a varying number of deciduous horny elements. Nostrils entirely unfeathered. Wings and tail ordinary. Feet small; tarsi shorter than middle toe, entirely reticulate; toes long, middle and outer of about equal lengths, claw of the former longest; inner claw reaching base of middle; all curved and compressed. Four species, very distinct; the queerest little auks in the world. Each has been made type of a genus; *S. psittaculus* differs more from the rest than these do from one another, and might stand apart as a genus (*Phaleris*), the others being rated as subgenera (*Simorhynchus* proper, *Tylorhamphus*, and *Ciceronia*).

Analysis of Species.

Upper mandible oval, lower mandible falcate, rictus curved upward. No crest (*Phaleris*) . *psittaculus* 858
Upper mandible triangular, lower straight, rictus horizontal, sinuate.
A long frontal crest, curling over forward.
One series of white feathers on each side of head (*Simorhynchus* proper) . . . . . *cristatellus* 859
More than one series of white feathers on each side of head (*Tylorhamphus*) . . . . *pygmæus* 860
Short white hair-like feathers over the forehead; no crest (*Ciceronia*) . . . . . *pusillus* 861

858. S. psitta'culus. (Lat. *psittaculus*, a little parrot. Fig. 439.) PARROQUET AUK. PUG-NOSED AUK. Bill moderately large, much compressed, densely feathered for some distance at base, but not to the nostrils, which are narrowly oval, overhung by a projecting scale or shield, which is deciduous. Profile of bill oval; of upper mandible narrowly oval; culmen gently convex, declinate, tomial edge more convex, acclinate, meeting at an obtuse tip; lower mandible extremely slender, falcate, curved upward, with concave tomia, very convex gonys, and acute point. Frontal feathers embracing culmen with a reëntrance, thence dropping perpendicularly to commissure; those on lower mandible not reaching quite so far; interramal space fully feathered. Adult: In summer with the nasal saddle, moulted in one piece in winter; shape of bill not materially altered, however. the piece being small and flattish. Bill vermilion or coral-red, usually enamel-yellow at tip and along edges. No curly crest on forehead, but a series of long white filamentous feathers from the eye downward and backward. Entire upper parts, with chin, throat, breast, and

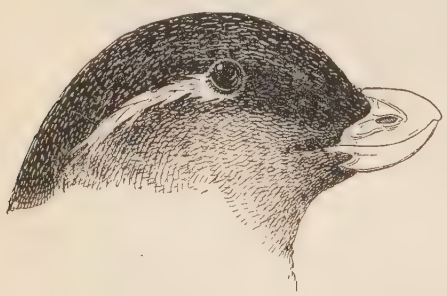

FIG. 539. — Parroquet Auk, nat. size. (Ad nat. del. H. W. Elliott.)

flanks sooty brownish-black, grayer below than above; other under parts white; lining of wings dark. Feet dull greenish or yellowish, darker behind and below. Length about 9.00; wing 5.40–5.75; tail 1.55; tarsus about 1.00; middle toe alone 1.10; chord of culmen or gonys 0.60; gape 1.00; depth of bill 0.45; width 0.30. Young: No white filamentous feathers on head; a white spot on lower eyelid; upper parts as before, under parts white, marbled and mottled with dusky ends of the feathers. N. Pacific and polar seas, highly arctic, apparently not coming much south. This quaintly-beaked bird resorts to cliffs and crags to breed, laying its single egg deep in the cavities of the most inaccessible rocks overhanging the sea; it resembles a small narrow hen's egg, being white, variously soiled and discolored, minutely granular and rough to the touch, 2.25 to 2.35 long by 1.45 to 1.50.

Fig. 540. — Crested Auk, reduced. (Ad. nat. del. H. W. Elliott.)

359. **S. cristatel'lus.** (Lat. *cristatellus*, dimin. of *cristatus*, crested. Figs. 540, 541, 542.) Crested Auk. Snub-nosed Auk. Bill fundamentally small and simple, compressed-conic, with convex culmen and little sinuate horizontal commissure; but in the breeding season developing several corneous appendages, which alter its shape greatly, make it singularly irregular, and modify even the outline of the feathers at its base. These accessory pieces are: a nasal plate, filling the nasal fossa, separate from its fellow of the opposite side; a subnasal strip prolonged on the cutting edge of the upper mandibles backward from the nostrils; a rosette-like plate at base of upper mandible just over angle of the mouth; a large shoe encasing the posterior part of the under mandible; the latter single, the other three pieces in pairs, making seven in all which are moulted; all these elements vermilion or coral-red; end of the bill enamel-yellow. (Before acquiring these growths the young bird is *tetraculus* of authors; the adult in winter, after

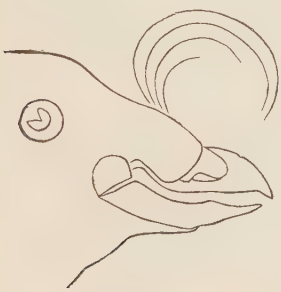

Fig. 541. — Crested Auk, in summer, nat. size.

Fig. 542. — Crested Auk, in winter, nat. size.

shedding them, is *dubius*.) A beautiful crest of 12–20 slender feathers springing from the forehead, curling over forward in arc of a circle to fall gracefully upon the bill; this helmet is blackish; at full length about 2 inches long; the feathers are not filamentous, but have well-formed webs, and are bundled or impacted together, owing to the oblique divergence of the

webs from the shaft, as in the genus *Lophortyx*. A slender series of white filamentous feathers over and behind each eye, drooping downward and backward. The whole plumage otherwise sooty — more brownish-black above, more brownish-gray below. Feet bluish, with dark webs. Aside from the transformation of the bill, the young only differ in lacking the crest and white filaments; but both are early acquired; there is a white spot below eye. The summer and winter plumages are alike. Iris said to be in winter white, in summer with a blackish outer and bluish inner ring; in the young, brown. Length 8.50–9.00; wing 5.25–5.50; tail 1.55; tarsus 0.90–1.00; middle toe and claw 1.35; chord of culmen 0.45. N. Pacific, both coasts and islands, on the Asiatic side to Japan, but not known to come S. to U. S. Nesting in every respect like *S. psittaculus;* single egg, similar, smaller, 2.10 × 1.40.

860. S. pygmæ'us. (Lat. *pygmæus*, dwarf. Figs. 543, 544.) WHISKERED AUK. RED-NOSED AUK. Bill small and simply conic-compressed, little longer than high, resembling the young or winter bill of the preceding; having but one pair of accessory pieces, the small shields which fill the nasal fossæ, and are doubtless shed in winter. Adult: A very long curly crest of slender filamentous feathers curving over forward in arc of a circle to droop upon the bill; the crest dark-colored and of same general character as that of *S. cristatellus*, but of fewer and more thready feathers. A maxillary series of slender filaments from the commissure of the bill along the side of the jaw; another series from base of culmen to eye; a postocular series adown the side of the neck, all these white or yellowish-white. Crest and general plumage as in the last.

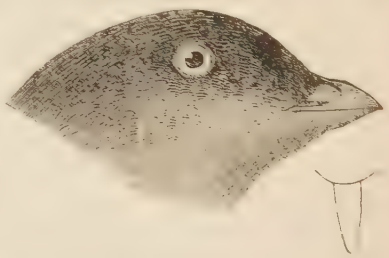

FIG. 543. — Whiskered Auk, young, nat. size. (From Elliott.)

FIG. 544. — Whiskered Auk, adult, nat. size. (From Elliot.)

Bill (dry) orange-red, more salmon color or yellow enamel at end; feet (dry) undefinably dark. Length 8.00 or more; wing 5.60; tail 1.25; tarsus 1.00; middle toe and claw 1.55; outer do. 1.60; inner do. 1.10; chord of culmen 0.45; depth of bill at base 0.30; gape 0.90; crest outstretched 1.50; longest white filaments on head 1.00. Young: Bill very small and weak, much compressed. No sign of crest nor of white feathers on head. Above blackish-cinereous, quite black on head, wings, and tail; under parts lighter and more grayish-plumbeous, bleaching on the belly and crissum. Bill reddish-dusky; tarsi behind and soles black; eye black and white. (*S. cassini*, Coues.) N. Pacific; apparently rare in most localities; there are as yet but few specimens in any museums.

861. S. pusil'lus. (Lat. *pusillus*, puerile. Figs. 545, 546, 547.) LEAST AUK. KNOB-NOSED AUK. Adult in summer: Bill small and simple, but stout for its length, scarcely higher than wide at base, rather obtuse at tip. A small knob or tubercle at the base of the culmen, which is deciduous. No crest; but front, top, and sides of head more or less thickly lined with delicate white thready feathers; a similar series, exceedingly fine, from the eye along sides of hind head and nape. Excepting these filaments, the entire upper parts glossy black; region about under mandible, and a few feathers along the sides of body and flanks, blackish; under parts white, more or less extensively mottled or clouded with blackish. Lining of wings white, with dark feathers along the edge. Bill red, the knob and base of upper mandible dark. Legs (dry) undefinably dark, the front of tarsus and tops of toes lighter. Length 6.50; wing 3.75;

tail 1.25; tarsus 0.70; middle toe and claw 1.00; chord of culmen, including the node, 0.40; gape 0.60; height of bill at base 0.30, width scarcely less. In winter: The knob gone; the little white bristles of head retained; white of under parts extensive, reaching far around sides of neck; humeral and scapular feathers and many of the secondaries marked with white, producing patches of this color on the upper parts, unknown in other *Phaleridinæ;* such seasonal change of *plumage* indicating an approach to *Mergulus* or *Brachyrhamphus.* Young: Like the adults, but the white of the under parts nebulated with dusky ends of the feathers; this clouding does not clear up until the knob of bill and bristles of head have been acquired.

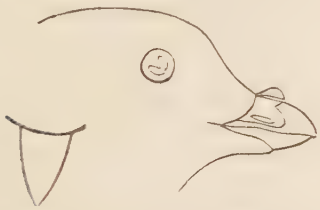

FIG. 545. — Least Auk, adult, nat. size.

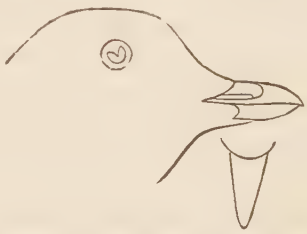

FIG. 546. — Least Auk, young, nat. size.

This curious little bird, the smallest of all the auks, and one of the least of all water birds, inhabits the coasts and islands of the N. Pacific, resorting to favorite breeding places by millions, with *S. psittaculus* and *S. cristatellus.* The nesting is similar, the single egg being laid in the recesses of rocky shingle over the water; size 1.55 × 1.12. The bird is not known to come S. so far as the U. S.

FIG. 547. — Group of Least Auks. (Designed by H. W. Elliott.)

341. PTYCHORHAMPHUS. (Gr. *πτύξ, πτυχός. ptux, ptuchos,* a fold: *ῥάμφος. hramphos,* beak.) WRINKLE-NOSED AUKS. Size moderate; form stout; no crests nor any peculiar feathers about head. Bill about ⅔ as long as head, stout, straight, little compressed, conic-acute; culmen little convex, broad at base, where in the dried state transversely corrugated; in place of which wrinkles there may be some formation now unknown; sides of upper mandible

turgid, with inflected tomial margins; of under upright, grooved lengthwise; gape straight; gonys straight or nearly so, very long. Nasal fossæ large, shallow, covered with soft skin in the only state known; which flares over the rather long, narrowly oval sub-basal nostrils at the bottom of the fossa. Outline of frontal feathers nearly transverse across culmen, thence retreating obliquely to the commissure. Tarsi reticulate, much shorter than middle toe without claw. This genus apparently connects the *Phaleridinæ* with the *Alcinæ*, having much the aspect of *Mergulus* or *Brachyrhamphus*, with sui generis shape of bill; its position will only be settled by learning what, if any, are the transformations of the bill.

862. **P. aleu'ticus**. (Of the Aleutian Islands.) ALEUTIAN AUK. Bill black, the skinny part pale in the only state observed; feet blackish behind and below, bluish in front of tarsus and on tops of toes. A touch of white about eye. Upper parts blackish-plumbeous, the head, wings, and tail nearly black. This dark color, diluted to grayish-plumbeous, extends around the head, neck, and fore-breast, along the sides, and on lining of wings, fading to white on belly and crissum. No special states of plumage are known. Length 8.00–9.50; extent 16.00–18.50; wing 4.75–5.25; tail 1.50–1.75; tarsus about 1.00; middle toe and claw 1.40; outer do. 1.30; inner do. 1.10; culmen 0.75; gape 0.90; gonys 0.60; depth of bill at base 0.40, width 0.30. Pacific coast of N. A., Aleutians to L. Cala., thus not specially Arctic. Breeds as far south at least as the Farallones.

77. Subfamily ALCINÆ: Guillemots, Murres, and Auks proper.

See analysis on p. 799, and characters of subfamily *Phaleridinæ*. Among the *Alcinæ*, that is to say, Auks with feathered nostrils and unappendaged bill, there is a gentle gradation from those genera in which the bill is simplest and slenderest, as in the Guillemots and Murrelets, to those in which it is stoutest, as in some of the Guillemots, and in the razor-billed and great auks, in which it is greatly compressed and sulcate, recalling that of a puffin. Some of the genera are confined to the North Pacific, as *Synthliborhamphus* and *Brachyrhamphus;* others are circumpolar, as *Uria* and *Lomvia;* several, as *Alle, Uria, Lomvia, Utamania* and *Alca*, represent the family in the North Atlantic, together with *Fratercula* of the *Phaleridinæ*.

342. **AL'LE.** (A local name of the bird.) SEA DOVE. Size small; form squat and bunchy. Bill very short, stout, and obtuse, as wide as high at base, the sides of both mandibles turgid, the edge of the upper much inflected; culmen very convex; rictus ample, decurved at end; gonys straight, very short, the mandibular rami correspondingly long, and widely divaricated; nasal fossæ short, wide, deep, partly feathered. Nostrils sub basal, more nearly circular than in any other genus excepting the next. Wings rather long for this family; tail much rounded, with narrow pointed feathers. Feet small and weak; tarsus scarcely compressed, broadly scutellate in front, finely reticulate behind. One species.

FIG. 548. — Sea-dove, nat. size.

863. **A. ni'gricans**. (Lat. *nigricans*, blackening. Fig. 548.) SEA-DOVE. DOVEKIE. ALLE. Adults in summer: Head and neck all around, and entire upper parts, very glossy blue-black; scapulars edged and secondaries tipped with white, forming two conspicuous patches; touches of white about eyes. Under parts from the neck pure white, some of the long feathers of the flanks rayed with black; lining of wings dusky. Bill black; mouth yellow; feet black behind and below, in front and above flesh-colored; eyes brown. In winter: The white of under parts extending to the bill, and on sides of neck nearly around. Young like adults in winter, but upper parts duller; bill smaller; feet dusky greenish, the scales obscured. Length 8.50; extent 15.50; wing 4.75–5.25; tail 1.50; tarsus 0.80; middle toe and claw 1.20, outer do.

1.15, inner do. 0.85; chord of culmen 0.50, gape 1.00, gonys 0.20; height or width of bill at base 0.35. N. Atlantic, both coasts. In winter S. to the Middle States or beyond. Overtaken by storms at this season this little bird is not seldom blown inland. It is very abundant at its breeding grounds in the far north, being one of the most boreal of birds. Egg single, 1.60 × 1.10, pale greenish-blue.

343. **SYNTHLIBORHAM'PHUS.** (Gr. *συνθλίβω*, *sunthlibo*, I compress; *ῥάμφος*, *hramphos*, beak.) NIPPER-NOSED MURRELETS. Of moderate size and stout form; general aspect of *Alle;* with or without a crest. Bill somewhat as in *Brachyrhamphus*, but stouter and deeper for its length; greatly compressed throughout, its depth at base about half as much as length of culmen; culmen moderately convex, gonys ascending. Nostrils sub-basal, broadly oval or nearly circular; nasal fossæ small and shallow, feathered to nostrils. Feathers to about opposite points on culmen and keel, thence retreating rapidly backwards. Secondaries very short, as in *Brachyrhamphus*, the longest not reaching much more than half way from carpal joint to the point of the closed wing. (This style of wing is characteristic of the murrelets, which "paddle" the air in a peculiar way.) Tail short, nearly square, with broadly rounded feathers. Tarsi much compressed, like the bill; transversely scutellate in front and on the side, reticulate behind; about as long as middle toe without claw. With the general character of *Brachyrhamphus*, this genus differs in the deeper, stouter bill, and much compressed scutellate tarsi; it includes two very stylish species of the N. Pacific, very different from each other.

Analysis of Species.

Head closely feathered; depth of bill more than half its length; white of sides of crown not advancing before eyes . . . . . *antiquus* 864

Head crested; depth of bill about half its length; white of sides of crown advancing nearly to bill *umizusume* 865

864. S. anti'quus. (Lat. *antiquus*, ancient; i. e. gray-headed. Fig. 549.) BLACK-THROATED MURRELET. Adult in breeding dress: Bill whitish or yellowish, its base and ridge black. Feet whitish or yellowish, the tarsus behind and both surfaces of webs, black. Head all around, and throat, black, pure above, sooty on chin and throat. A conspicuous white stripe from over each eye to sides of nape, where connected by some white feathers with its fellow, and spreading on the sides and back of neck into a set of sharp white streaks; trace of white on each eyelid. Upper parts dark plumbeous, blackening on tail; upper surface of wing the same, the edging of the wing all along from the elbow, and the exposed parts of the primaries, blackish; secondaries like the coverts, or rather darker; basal portion of inner webs and shafts of primaries whitish; under surface of wing white, mottled with dusky just along the edges. Sides of body under the wings velvety-black; these black feathers lengthening behind, and overlying the flanks, which are seen to be white on raising them. Anteriorly this black extends in front of the wings and continues on to the nape of the neck, where it mixes with the white streaks above said. The sooty-black of the throat is continuous with that of the sides of the head as far as the auriculars, beyond which it narrows to a point on the throat, being separated from the black of the nape by a large white area, an extension to the auriculars of the white which is the color of the whole under parts, except as said. Length 9.50–10.50; extent 16.75–18.25; wing 5.50; tail 1.60; tarsus 1.00; middle toe and claw 1.25, outer do. 1.15, inner do. 1.00; bill along culmen 0.60, gape 1.20, gonys 0.40; depth at base 0.30, width 0.20. Young or winter: Upper parts darker, the plumbeous being obscured by dusky, especially on the wing- and tail-coverts and rump. Forehead, crown, nape, sooty-black, not relieved by white streaks, or only with traces of the latter; eyelids sometimes largely white. No black on throat, only

FIG. 549. — Black-throated Murrelet, nat. size.

some dusky mottling about base of bill; the white of the under parts extending on head nearly to eyes, and far around on sides of nape, so that only a narrow median line is left dark. Sides of body under wings merely dusky, not continuous over the flanks, where the feathers are partly white, and scarcely advancing in front of wings. The course of the seasonal plumages, or those dependent upon age, is not yet fully traced for this species; the clarity of the ash, the intensity of the black, and the purity and distinctness of the white striping, indicate the more perfect feathering, and conversely. N. Pacific, both Asiatic and American, S. in winter to the U. S., breeding from Sitka, Alaska. Accidental in one instance in Wisconsin.

865. **S. umizu'sume**. (The Japanese name. Fig. 550.) JAPANESE MURRELET. TEMMINCK'S AUK. Bill more elongate and acute than in the type of the genus, less compressed, not so deep for its length. Bill yellow, with black ridge; feet livid-bluish, with dusky webs. A large crest, of a dozen (more or fewer) feathers springing from extreme forehead, not recurved, but drooping backward over the occiput. A conspicuous series of white feathers on each side of head, from origin of the crest over eye to nape, where more or less confluent with those of opposite side, and then dispersed in streaks over the sides of the neck to the shoulders. Rest of head, including throat, sooty or ashy-blackish, this color extending as far as the interscapulars, whence the upper parts are more plumbeous, only darker on wings and tail. Sides under the wings plumbeous-black to the flanks, this color advancing in front of wings and continuous with that on the sides of neck and head. Lining of wings white, except some dark mottling along the edge; bases of primaries, and most of their inner webs, white, shading through gray to their dusky tips. Whole under parts white, except as said. Length 10.50–11.00; extent 18.00–18.50; wing 5.50; tail 1.75; tarsus 1.00; middle toe and claw 1.25, outer 1.20, inner 1.00; bill along culmen 1.00, gape 1.10; gonys 0.40; height or width at base 0.25–0.30. Younger: No crest; bill obscured; little or no trace of white about head, which is dusky plumbeous; other upper parts similar, the back lighter; white of under parts extending to bill and far around on sides of neck. There is much variation in different specimens, the full significance of which remains to be determined; but the species is unmistakable. N. Pacific, both Asiatic and American; S. to U. S. and Japan.

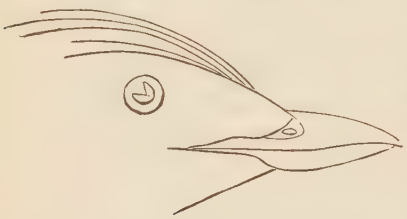

FIG. 550. — Japanese Murrelet, nat. size.

344. **BRACHYRHAM'PHUS**. (Gr. βραχύς, *brachus*, short: ῥάμφος, *hramphos*, beak.) PEAKED-NOSED MURRELETS. Approaching *Uria* in generic character. Bill small, slender, much shorter than head, not longer than tarsus, compressed, very acute; culmen gently curved, rictus and gonys straight; tomial edge of upper mandible much inflected toward base, notched near tip. Nasal fossæ small and shallow, nearly filled with feathers, reaching to the broadly oval nostrils. Wings very narrow, falcate, pointed, with extremely short secondaries. Tail nearly square, with obtuse feathers. Feet very small and short; tarsus of variable length relative to the toes, entirely reticulate. Outer and middle toes of equal lengths, the claw of the former smaller; inner toe short, its claw not reaching base of middle claw. Claws all small, compressed, acute. Containing several species of diminutive murres, all confined to the Pacific.

Analysis of Species.

Tarsus shorter than middle toe without claw.

Upper parts blackish and chestnut, lower blackish and white (summer), or upper parts cinereous and white, lower white (winter) . . . . . *marmoratus* 866

Upper parts ashy, barred and spotted with dull yellowish; under parts whitish barred with dusky. *kittlitzi* 867

Tarsus as long as middle toe without claw.

Lining of wings white . . . . . *hypoleucus* 865
Lining of wings dark . . . . . *craverii* 869
Tarsus said to be longer than middle toe . . . . . *brachypterus* 870

866. B. marmora'tus. (Lat. *marmoratus*, marbled.) MARBLED MURRELET. WRANGEL'S MURRELET. Adult in summer: Bill black; tarsi behind and both surfaces of webs blackish; tarsi in front and top of toes livid flesh-color, or dull bluish-gray; iris brown. Above, brownish-black, barred crosswise with chestnut-brown, or bright rust-color, except on the wings, which are uniform brownish-black, the primaries darker, their inner webs gray toward the base. Lining of wings smoky brownish-black. A few whitish feathers, varied with chestnut and dusky, on the scapulars. Entire under parts, including sides of head and neck, marbled with sooty brownish-black and white, the feathers being white with dark ends. Adult in winter: No chestnut, and entire under parts pure white, immaculate, excepting some dusky streaks on the long feathers of the sides and flanks. Upper parts very dark cinereous, the centres of the feathers, especially of the back and rump, blackish; the crown, wings, and tail almost black, the greater coverts narrowly edged with white; the scapulars almost entirely white, forming two conspicuous patches. On the lores, the white invades to the level of the eyes, and extends into the nasal fossæ; it then dips, leaving the eyes in dark color; on the nape it reaches nearly across the middle line; on the sides of the rump it leaves a band of dark color about an inch wide. Specimens are found in every stage intermediate between the two here described. Young, first plumage, with bill only a third as long as head: Resembling the winter adult, in absence of chestnut. Upper parts blackish, with only a shade of cinereous, therefore darker than in the winter adult; white on scapulars present, but restricted, and interrupted with dusky. Entire under parts white, as before, but thickly marked with fine wavy dusky lines, most numerous across throat, largest on sides and flanks, finest on lower breast, the chin, middle of belly and crissum unmarked. Lining of wings as before. Length 10.00; extent 18.00; wing 5.00; tail 1.50; tarsus 0.70; middle toe alone, 1.00, its claw 0.20; outer toe and claw 1.15; inner do. 0.90; bill along culmen 0.60–0.70, gape 1.25–1.35, gonys 0.45–0.55, height at base 0.24, width 0.20. Coasts and islands of the N. Pacific; on the American side, S. in winter to S. Cala.; breeds as far south at least as Vancouver, and apparently does not penetrate far north.

867. B. kittlit'zi. (To F. H. v. Kittlitz.) KITTLITZ'S MURRELET. Related to the last, and belonging to the same section of the genus, having the tarsi shorter than middle toe without claw. Bill about one-third as long as the head. Length about 9.00. Above, cinereous of lighter and darker shades, spotted and barred with dull yellowish. Below, whitish, undulated with dusky. Wings blackish. This is the substance of Brandt's description of this species, which is quite distinct from the foregoing. The bird was originally described from Kamtschatka; two specimens have lately been taken from the Aleutian Islands by Mr. E. W. Nelson and Mr. L. M. Turner. They are preserved in the National Museum, where I have handled one of them, but are not at present accessible to me for description.

868. B. hypoleu'cus. (Gr. *ὑπό, hupo*, below, *λευκός, leukos*, white.) WHITE-BELLIED MURRELET. Adult in winter: Bill ½ the head, ¾ the tarsus, as long as middle toe and half its claw, very slender. Tarsus equal to middle toe without claw. Entire upper parts unvaried cinereous, slightly darker on head; this color extending on head to include eyelids, and a little farther down on the nape; thence in a straight line along middle of side of neck to shoulders, thence along sides of body in a strip nearly an inch broad, the elongated flank-feathers being also of this color; other under parts pure white, *including* lining of the wings. Primaries black, the greater part of their shafts and inner webs whitish. Bill black, the base of lower mandible pale; feet whitish-blue, black below. Length 10.00–10.50; extent 16.00–17.50: wing 4.75; tail 1.75; tarsus 0.95; middle toe without claw 0.95, its claw 0.20; outer toe and claw 1.10; inner do. 0.90; bill 0.80; gape 1.30; gonys 0.45; depth of bill at base 0.22; width 0.19. S. and L. Cala.

869. **B. craveri?** (To F. Craveri. Fig. 551.) CRAVERI'S MURRELET. Resembles the last; questionably distinct: differs in having the under surface of the wing dark. L. California, both sides.

870. **B. brachypterus?** (Gr. *βραχύς, brachus*, short; πτερόν, *pteron*, wing.) SHORT-WINGED MURRELET. Tarsus said to be longer than middle toe. Bill about ½ as long as head. Above, cinereous, the wings and tail blackish. Neck on sides and below, breast and belly white. Length 9.00. Unalashka. (This is the substance of Brandt's original description. The alleged species is unknown to me, and no specimens are known to exist in this country.)

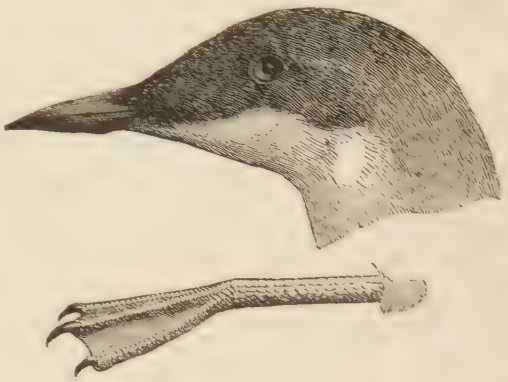

FIG. 551. — Craveri's Murrelet, nat. size. (From Elliot.)

345. **URIA.** (Gr. *οὐρία, ouria*, a kind of water fowl.) BLACK GUILLEMOTS. Bill much shorter than head, about equal to tarsus, straight, rather stout, moderately compressed; culmen at first straight, then decurved; gape straight to near tip; gonys short, straight, ascending, about ½ as long as culmen. No nick or groove near tip of upper mandible; its tomial edge scarcely inflected. Nasal fossæ large and deep, partially filled with feathers which do not entirely cover the nostrils. Feathers salient in rounded outline on side of lower mandible. Tail little rounded, contained 2⅔ times in length of wing. Tarsus entirely reticulate, slightly shorter than middle toe without claw. Claws compressed, arched, acute, the outer grooved on outer side, the middle dilated on inner edge. No postocular furrow in plumage. Color black, relieved with white on head or wing, bill black, feet red; in winter, largely white. Eggs plural, colored. Three or four species.

Analysis of Species.

A large white mirror on wing above and below, entire; no white about head . . . . . *grylle* 871
A large white mirror on wing above, partly divided; none below; no white about head . . . . *columba* 872
No white mirror on wing; parts about eye and bill white . . . . . *carbo* 873

871. **U. grylle.** (N. European name of the bird. Fig. 552.) BLACK GUILLEMOT. SEA-PIGEON. Adult in full dress: Plumage sooty-black with a tint of "invisible" green; wings and tail pure black; former with a large white mirror on both surfaces; bill and claws black; mouth and feet carmine, vermilion or coral red; eyes brown. This faultless dress-suit is only worn about two months. In August, the wings and tail fade to gray; the body-color loses the green gloss; the white mirror is soiled with brown. When the quills and tail-feathers have fallen, and new ones partly grown, the progress of the moult gives a new clean white mirror, smaller than in midsummer; head and neck all around, rump and under parts, marbled with black and white, the bird looking as if dusted over with flour; back black, the feathers mostly edged with white. Completion of the moult gives the following winter plumage: Wings and tail black, the white mirror faultless; head and neck all around, rump and under parts, white; back and more or less of the hind neck and head black, variegated with white. Young in first plumage: Bill black, feet dusky reddish. Upper parts plumbeous

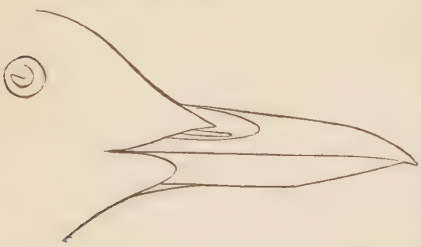

FIG. 552. — Black Guillemot, nat. size.

or sooty, little varied with white; under parts white, marbled, rayed and waved with dusky; incipient mirror spotty. Nestlings are covered with sooty brownish-black down; bill and feet brownish-black. Perfectly white and entirely black birds are rarely seen. The mirror on the upper surface of the wings is composed of the terminal half (more or less) of the greater coverts, the rest dark; of the several next rows excepting their dark bases, the white of these coverts normally overlying and concealing the dark basal portions of the greater coverts, so that the oval mirror is usually unbroken; the anterior border of the mirror is the line through the union of white tips with dark bases of the row of lesser coverts about ½ an inch from the fore-arm edge of the wing. When, as not seldom happens, the row of greatest coverts are dark beyond the extent of the next row, this dark being thus uncovered, shows as a wedge partly splitting the mirror, as normally occurs in *U. columba*. Or, the greater row of coverts may be entirely dark, when the mirror is unbroken, as before, but much smaller; or, again, the middle row of coverts may be tipped with dark, making a break across the mirror, but in a different method from that first described. Finally, the mirror may be only indicated by isolated white feathers, or wholly wanting. Length, average, 13.00; extent, average, 22.50; wing 5.50-6.25; tail about 2.00; tarsus 1.25; middle toe and claw 1.75; bill 1.30; gape 1.75; gonys 0.65; depth of bill at base 0.45, width 0.35. Eur. and N. Am. coasts and islands of the N. Atlantic, very abundant; rare or casual in the N. Pacific, where replaced by the succeeding species; occurring in the Arctic Ocean, but apparently mostly replaced by *U. mandti*; in N. A. occurring in Hudson's Bay, and S. in winter to the Middle States. Gregarious; flying in close flocks low over the water; nesting scattering in rifts of rock near the water; eggs 2–3, sea-green, greenish-white or white, spotted and blotched most irregularly with blackish-brown, and with purplish shell-markings; size 2.25 to 2.50 × 1.50 to 1.60; shape nearly elliptical, not pyriform like those of Guillemots; laid in June, July.

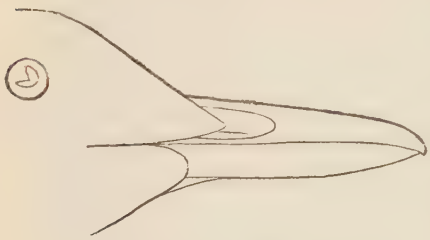

Fig. 553. — Pigeon Guillemot, nat. size.

872. U. colum'ba. (Lat. *columba*, a pigeon. Fig. 553.) Pigeon Guillemot. Bill stouter than that of grylle, and more obtuse. No white on under surface of the wing. White mirror of upper surface nearly split in two by an oblique dark line, caused by the extension of the dark bases of the greater coverts, in increasing amount from within outward, till the outermost are scarcely tipped with white; consequently there is a dark wedge between the white ends of the greater and middle rows of coverts. Plumage and its changes otherwise as in the foregoing; general habits and nesting the same. Asiatic and Am. coasts and islands of the N. Pacific; breeds as far south as California.

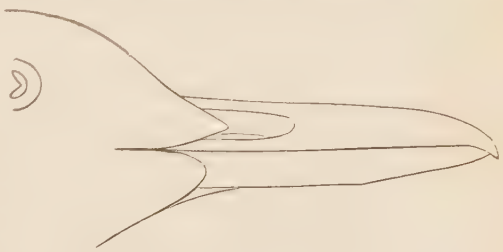

Fig. 554. — Sooty Guillemot, nat. size.

873. U. car'bo. (Lat. *carbo*, a coal; i. e. black. Fig. 554.) Sooty Guillemot. Spectacled Guillemot. Like the last; larger, especially the bill. No white on either surface of wings. A pair of white spectacles on the eyes, and whitish about base of bill. General plumage and its changes as in others of the genus; bill and feet the same. Length 14.00–15.00; wing 7.75; tail 2.50; tarsus 7.35; middle toe and claw 2.10; bill 1.55–1.70 along culmen, along gape 2.20, from feathers on side of lower mandible 1.50; depth at base 0.50; width 0.38. N. Pacific, in higher latitudes; British Columbia to Japan. An interesting species, still rare in collections.

346. **LOM'VIA.** (N. European name of birds of this kind.) MURRES. GUILLEMOTS. EGG-BIRDS. Bill shorter than head, longer than tarsus, straight or slightly decurved, much compressed; culmen regularly curved throughout; rictus curved in most of its length; gonys straight, or little curved, nearly as long as culmen; upper mandible grooved on the side near tip, its commissural edge greatly inflected. Nasal fossæ fully feathered. Feathers on lower

FIG. 555. — Gathering Murre's eggs in Alaska. (Designed by H. W. Elliott.)

mandible retreating in straight oblique line from interramal space to rictus. Tail short, much rounded, contained over 3 times in length of wing. Tarsus compressed, much shorter than middle toe and claw; outer claw not grooved on outer face. A furrow in plumage behind eye. Colors dark above, white below. Egg single, pictured, pyriform.

Analysis of Species.

Depth of bill opposite nostrils not more than ½ the length of culmen.
- Bill comparatively slender, not dilated along edge of upper mandible at base, the culmen, commissure and gonys curved. Atlantic . . . . . *troile* 874
- Bill stouter, somewhat dilated along edges of upper mandible at base, the culmen, rictus, and gonys nearly straight. Pacific . . . . . *californica* 875

Depth of bill opposite nostrils more than ½ the length of culmen.
- Bill very stout, thick, deep, much dilated along edges of upper mandible at base; culmen, commissure and gonys curved . . . . . *arra* 876

874 **L. troile.** (Nom. propr., of uncertain reference. Figs. 556, 557, 560.) COMMON GUILLEMOT, or MURRE. Adult in summer: Head and neck all around rich dark maroon brown, changing on upper parts into dark slaty-brown, nearly uniform, but most of the feathers of the back and rump with slightly lighter, more grayish-brown, edges. Secondaries narrowly but distinctly tipped with white. Under parts from the throat pure white, the sides and flanks marked with dusky or slaty, the lining of the wings varied with white and dusky. Bill black; mouth yellow; eyes brown; feet blackish. In some cases, not in most, a white "eye-glass," consisting of a rim around eye

and handle back of eye in the furrow of the plumage. In winter: White of under parts reaching to the bill, on sides of head to level of the commissure, farther around on sides of neck, leaving only a narrow isthmus of dark color; the two colors shading without distinct line of demarcation; usually a spur of dark color in the furrow behind eye. Young, first winter, like the adults at that season; bill shorter and weaker, and, like the feet, in part light-colored. Fledglings dusky brownish, with white breast and belly, and whitish about head and neck. Length 17.00; extent 30.00; wing 8.00; tail 2.25; tarsus 1.40; middle toe and claw 2.10; outer do. 2.00; inner do. 1.70; bill along culmen 1.75; gape 2.50; gonys 1.15; depth at base 0.55; width 0.30. European and American coasts and islands of the N. Atlantic, to or beyond 80° N.; on the Amer. side breeding from Nova Scotia northward; in winter to the Middle States.

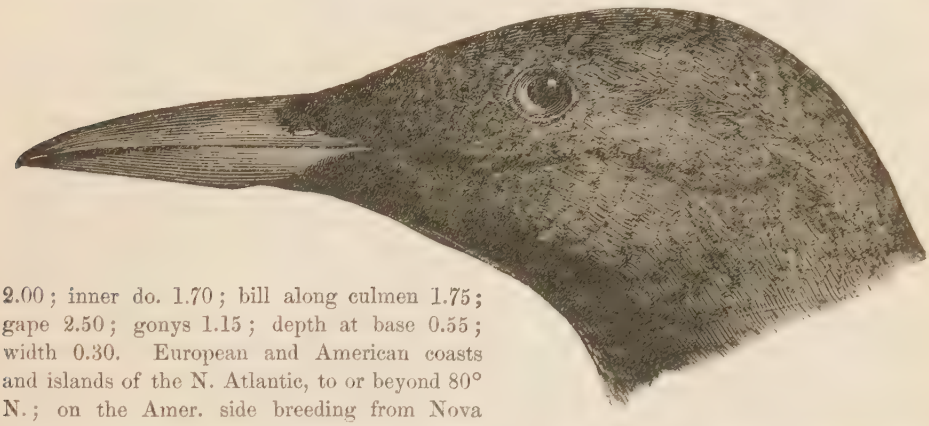

FIG. 556. — Common Guillemot, or Murre, nearly nat. size. (From Elliot.)

Myriads of murres congregate to breed on rocky islands, incubating their single eggs as closely together as they can find standing-room on the shelves of the cliffs; their ranks serried on ledge after ledge, and clouds of birds whirling through the air. The eggs, so numerous as to have commercial value, are notorious for their variability in coloration. The size is great for that of the bird, averaging 3.25 × 2.00, running unusually from 3.00 to 3.50, with half as much variation in breadth. The ground color ranges from creamy to pure white, then through earthy, grayish, bluish, or greenish-white to sea-green and every darker shade of green. The markings of the creamy and white varieties are generally spots and blotches of different shades of brown, pretty uniformly dispersed, and eggs of this type resemble those of the razor-bill, but may usually be distinguished by larger size (in length) and more pyriform shape. The green eggs are endlessly varied, in pattern of the markings, but are normally more streaked in sharp angular zigzag lines, inextricably confused, reminding one of Chinese literature.

FIG. 557. — Common Guillemot, nat. size.

875. L. t. califor'nica. (Fig. 558.) CALIFORNIAN GUILLEMOT. Like the last. Bill averaging somewhat longer, about 1.90; culmen, commissure, and gonys nearly straight; upper mandible somewhat dilated toward the base along the cutting edges, and less feathered; gonydeal angle prominent. The bill consequently approaches that of the next species, in width and depth, but exaggerates the length and straightness of that of the last species. Pacific coast of N. Am., breeding from islands in Behring's sea to California.

876. L. ar'ra. (Russian name, *arrie*. Fig. 559.) THICK-BILLED GUILLEMOT. ARRIE. Like the foregoing in plumage and its changes. Form very robust. Bill short, stout, wide, deep: culmen curved throughout; commissure decurved at end; gonys if anything concave in outline, the angle very protuberant; cutting edges of the upper mandible dilated and denuded toward the base,

this bare turgid space flesh-colored in life, drying pale yellowish. Length 18.00; extent 32.00; wing 8.50; tarsus 1.25; bill along culmen 1.40, along gape 2.20; gonys 0.90; depth at angle 0.55, width at base of nostrils 0.30, at angle of mouth 0.80. N. Atlantic and Polar and N. Pacific shores and islands, in myriads; on the Atlantic S. in winter to the Middle States, breeding from the Gulf of St. Lawrence northward. The N. Pacific form, unquestionably of the "thick-billed" species, does not exhibit the extreme of shortness and stoutness as just described for the Atlantic: with a culmen of about 1.67, the depth opposite nostrils is hardly 0.67, thus less than half the length of culmen, instead of about half; gape nearly 3.00. The sides of the upper mandible are characteristically dilated and denuded, of a glaucous bluish color; the tip of the bill is less deflexed, though more so than in the common guillemot. This is the great "egg-bird" of the high N. Pacific; on St. George's, one of the Prybilov group, for example, the birds "go flying around the island in great files and platoons, always circling against or quartering, on the wing, at regular hours in the morning and the evening, making a dark girdle of birds more than a quarter of a mile broad and thirty miles long, whirling round and round the island, and forcing upon the most casual observer a lasting impression." The N. Pacific form is *L. arra* proper; that of the N. Atlantic is "Brünnich's guillemot," differing as said, and perhaps constituting a subspecies apart (*L. a. svarbag*).

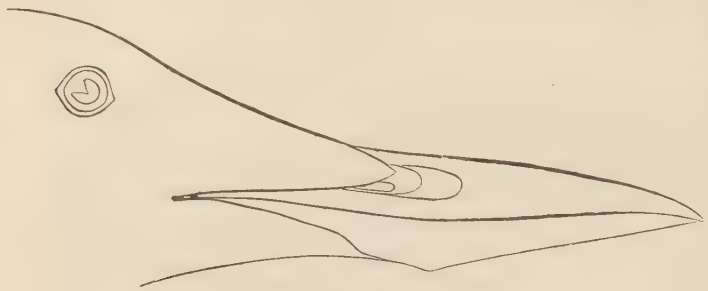

FIG. 558. — Californian Guillemot, nat. size.

347 **UTAMA'NIA**. (Cretan name of the bird.) RAZOR-BILL AUK. Size, form, and general aspect of the last genus. Bill about as long as head, densely feathered for half its length, the feathers extending on upper mandible beyond middle of commissure, those on lower somewhat farther. Bill greatly compressed, cultrate, sulcate, hooked; culmen ridged, regularly convex; commissure straight to the hook; gonys about straight. Nostrils linear, marginal, densely feathered. Tarsi scutellate in front. Tail short, pointed, of stiffish, acute feathers. Wings normal, effective for flight. Bicolor. Egg single, colored. One species.

FIG. 559. — Thick-billed Guillemot, nat. size.

877. **U. tor'da**. (Name of the bird.) RAZOR-BILLED AUK. TINKER. Adult in summer: Bill and feet black, the former with a white line occupying the length of the middle sulcus on both mandibles; mouth yellow; eye bluish. A strict, sunken line of white from eye to base of culmen. Head and neck all around and upper parts black, glossy and intense on the latter lustreless opaque brownish-black on the sides and front of the former. Tips of secondaries and entire under parts from the neck, including lining of wings, white. In winter: White reaching to bill, and invading sides of head and neck; the dark parts duller. Young: Like the adults in winter; smaller; duller; bill unformed, and like the feet not black. Nestlings clothed with sooty down, paler or whitish below. In the adults, the sharp white line from bill to eye is very characteristic, appearing with the first feathering, but sometimes fails in winter birds. Length about 18.00; extent 27.00; wing 7.75; tail 3.50, graduated 1.25;

tarsus 1.25; middle or outer toe and claw 2.00, inner 1.40; chord of culmen 1.30, arc 1.50; gape 2.25; gonys 0.75; greatest depth of bill 0.90. This auk abounds in the N. Atlantic, both coasts, and parts of the Polar seas; casual in the N. Pacific; Japan. On our coast, breeds in great numbers in the Gulf of St. Lawrence, about Newfoundland and Labrador strays S. in winter to the Middle States, like other *Alcidæ*. The eggs are usually laid in caverns and fissures of the rocks along precipitous shore-lines, often with those of sea-pigeons and puffins; about 3.00 × scant 2.00, white with creamy or milky-bluish tint, never green like those of murres, spotted and blotched, but not fantastically traced over, with different shades of umber-brown; less pointed; laid in June and July.

FIG. 560. — Murres.

348. **AL'CA.** (Lat. from *alk* or *auk*.) HIS GRACE, THE AUK, who lost the use of his wings, and perished off the face of the earth in consequence.

878. **A. Impen'nis.** (Lat. *impennis*, wingless. Fig. 561.) THE GREAT AUK. Largest of the family: length about 30.00 inches; wing 6.00; tail 3.00; bill along gape 4.25; chord of culmen 3.15; greatest depth of upper mandible 1.00, of lower 0.67; greatest width of bill 0.67; tarsus 1.67; middle toe and claw 3.25; outer do. 3.00; inner do. 2.25. A great white oval spot between eye and bill. Hood and mantle dark; under parts white, extending in a point on the throat; ends of secondaries white. Bill black, with white grooves; feet dark. Special interest attaches to this bird, which is now doubtless extinct, largely through human agency. It formerly inhabited this coast from Massachusetts northward, as attested by earlier observers, and by the plentiful occurrence of its bones in shell-heaps; also Greenland, Iceland, and the N. W. shores of Europe, to the Arctic Circle. On our shores it was apparently last alive at the Funks, a small island off the S. Coast of Newfoundland; while in Iceland, its living history has been brought down to 1844. For some years, it was currently, but prematurely, reported extinct. Mr. R. Deane has recently recorded (Am. Nat. vi, 368) that a specimen was "found dead in the vicinity of St. Augustine, Labrador, in November, 1870;" this one, though in poor condition, being sold for $200, and sent to Europe. But there appears to be some question respecting the character, date, and disposition of this alleged individual; and it seems very improbable that the species lived down to 1870. I know of only four speci-

mens in this country, — in the Smithsonian Institution, in the Philadelphia Academy, the Cambridge Museum, and Vassar College, Poughkeepsie (the latter the original of Audubon's figures). There is an egg in each of the first two mentioned collections. In pattern of coloration the egg is like that of the razor-billed auk, though it is of course much larger, measuring about 5.00 × 3.00. About 70 skins appear to be preserved in various museums, with as many eggs, some half dozen more or less complete skeletons, and other bones representing perhaps a hundred individuals.

FIG. 561. — Great Auk. (From Sport with Gun and Rod. The Century Co., N. Y.)

Part IV.

SYSTEMATIC SYNOPSIS

OF THE

FOSSIL BIRDS OF NORTH AMERICA.

There is at present no satisfactory evidence that Birds existed in North America before the Jurassic period; the footprints in the sandstone of the Connecticut Valley attributed to Birds having probably all been made by Dinosaurian Reptiles (p. 63). A number of Cretaceous Birds have been known for some years, as given in the original edition of this work (1872); but it is only since 1881 that this class of vertebrates has been traced back to the Jurassic by the discovery of *Laopteryx priscus* on a geologic horizon nearly that of the famous *Archæopteryx*.

The Tertiary Birds of North America belong to genera identical with, or nearly related to, those now living (p. 64). The case is otherwise with the earlier forms from the Cretaceous and the Jurassic, which represent different primary divisions of the class *Aves* (p. 237), comparable in taxonomic value to that one (*Saururæ*) which is based upon the *Archæopteryx*, or to those afforded by the Ratite and the Carinate birds respectively. Most of these forms are *Odontornithes*, or Birds with teeth; having the teeth implanted either in grooves (*Odontolcæ*), or in sockets (*Odontotormæ*), as illustrated by the genera *Hesperornis* and *Ichthyornis* respectively.

In the original edition of the Key these Cretaceous types were ranged with those from the Tertiary, their characters not having been fully worked out at that time. They have since become well known, through Professor Marsh's splendid restorations and illustrations, in his great work entitled 'Odontornithes' (4to, Washington and New Haven, 1880).

It is deemed advisable to present the Fossil Birds of North America under the three categories of the Tertiary, the Cretaceous, and the Jurassic forms; the first-named being ranged under the several orders to which they are supposed to belong, as described in this work; the remainder, with few exceptions, being *Odontornithes*.

A. — Tertiary Birds.

CARINATÆ (p. 238).

PASSERES (p. 238).

1. **PALÆOSPIZA BELLA.**

Palæospiza bella, ALLEN, Bull. U. S. Geol. Surv. Terr., iv., no. 2, May 3, 1878, pp. 443–445, pl. i, figg. 1, 2. — Am. Journ. Sci., xv, May, 1878, p. 381. — Amer. Nat., xv, Mar., 1881, p. 253.

Based upon some beautifully preserved remains, from the insect-bearing shales of Florissant, Colorado, now deposited in the Museum of the Boston Society of Natural History. They consist of the greater part of the skeleton, including all the bones of the wings and legs excepting the femurs, but unfortunately lacking the bill. The impression of the feathers of the wings and tail are remarkably distinct, showing not only the general shape of these parts, but the shafts and barbs of the feathers themselves. The bones are all *in situ*, "and indicate beyond question a high ornithic type, probably referable to the oscine division of the *Passeres*. The lack of the bill renders it impossible to assign the species to any particular family, but the fossil on the whole gives the impression of Fringilline affinities." The approximate length of the specimen is seven inches.

PICARIÆ (p. 444).

2. **UINTORNIS LUCARIS.**

Uintornis lucaris, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 259. — COUES, Key, 1872, p. 347.

This bird was about as large as a robin, and apparently related to the woodpeckers. The only known remains are from the Lower Tertiary formation of Wyoming Territory. They are preserved in the Museum of Yale College.

RAPTORES (p. 496).

3. **AQUILA DANANA.**

Aquila danana, MARSH, Am. Journ. Sci., ii, Aug., 1871, p. 125. — COUES, Key, 1872, p. 347.

This species was nearly as large as the golden eagle (*A. chrysaëtus*). The only known remains were found in the Pliocene of Nebraska, and are preserved in the Yale Museum.

4. **BUBO LEPTOSTEUS.**

Bubo leptosteus, MARSH, Am. Journ. Sci., ii, Aug., 1871, p. 126. — COUES, Key, 1872, p. 347.

A species about two-thirds as large as the great horned owl (*B. virginianus*). The remains were discovered in the Lower Tertiary beds of Wyoming, and are now in the Yale Museum.

5. **PALÆOBORUS UMBROSUS.**

Cathartes umbrosus, COPE, Proc. Phila. Acad., xxvi, 1874, p. 151. — Ann. Rep. Chief of Engrs. U. S. A., 1874, p. 606.

Vultur umbrosus, COPE, Proc. Phila. Acad., xxvii, 1875, p. 271. — Ann. Rep. Chief of Engrs. U. S. A., 1875, p. 993. — Rep. Surv. W. 100th Merid., iv, pt. ii, p. 287, pl. lxvii, figg. 10–18, pl. lxviii, figg. 1–19.

From the Pliocene of New Mexico; remains found in the sands north of Pojuaque, representing a rapacious bird in size intermediate between the golden eagle and the turkey vulture;

referred at first to the genus *Cathartes*, afterward provisionally to the genus *Vultur*. As the description and figures clearly indicate a bird generically distinct from *Cathartes*, and as the improbability of the occurrence of a true *Vultur* in North America is extreme, it is suggested that this species be made the type of a new genus, *Palæoborus*, based upon the characters given by the describer.

GALLINÆ (p. 571).

6. **MELEAGRIS ANTIQUUS.**

Meleagris antiquus, MARSH, Am. Journ. Sci., ii, Aug., 1871, p. 126. — COUES, Key, 1872, p. 347.

This species was nearly as large as the wild turkey (*M. gallipavo*). The remains representing it were found in the Miocene of Colorado, and are preserved in the Yale Museum.

7. **MELEAGRIS ALTUS.**

Meleagris altus, MARSH, Proc. Phila. Acad., Mar., 1870, p. 11. — Amer. Nat., iv, July, 1870, p. 317. — Am. Journ. Sci., iv, Oct., 1872, p. 260. — COUES, Key, 1872, p. 348.

Meleagris superbus, COPE, Syn. Ext. Batrach., etc., p. 239.

"Represented by portions of three skeletons, of different ages, which belonged to birds about the size of the wild turkey, although proportionally much taller. The tibiæ and tarso-metatarsal bones were, in fact, so elongated as to resemble those of wading birds." From the Post-pliocene of New Jersey. The remains are mostly in the Museum of Yale College.

8. **MELEAGRIS CELER.**

Meleagris celer, MARSH, Am. Journ. Sci., Oct., 1872, p. 261. — COUES, Key, 1872, p. 348.

A species much smaller than the foregoing, but with legs of slender proportions. Also from the Post-pliocene of New Jersey, and preserved in the Yale Museum.

LIMICOLÆ (p. 596).

9 **CHARADRIUS SHEPPARDIANUS.**

Charadrius sheppardianus, COPE, Bull. U. S. Geol. Surv. Terr., vi, no. 1, Feb. 11, 1881, pp. 83–85. — Amer. Nat., xv, Mar., 1881, p. 253.

ALECTORIDES (p. 665).

10. **GRUS HAYDENI.**

Grus haydeni, MARSH, Am. Journ. Sci., xlix, March, 1870, p. 214. — COUES, Key, 1872, p. 348.

A species about as large as the sandhill crane (*G. canadensis*). From the Pliocene of Nebraska. Remains preserved in the Museum of the Philadelphia Academy.

11. **GRUS PROAVUS.**

Grus proavus, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 261. — COUES, Key, 1872, p. 348.

This species was nearly as large as a sandhill crane. The remains representing it were found in the Post-pliocene of New Jersey, and are now in the Yale Museum.

12. **ALETORNIS NOBILIS.**

Aletornis nobilis, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 256. — COUES, Key, 1872, p. 348.

Nearly as large as the preceding species. Found in the Eocene deposits of Wyoming, and now in the Museum of Yale College.

13. **ALETORNIS PERNIX.**

Aletornis pernix, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 256. — COUES, Key, 1872, p. 348.

About half the size of the above, and from the same locality. Also in the Yale Museum.

14. **ALETORNIS VENUSTUS.**

Aletornis venustus, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 257. — COUES, Key, 1872, p. 348.

A smaller species, about as large as a curlew (*Numenius*). From the same locality, and likewise in the Yale Museum.

15. **ALETORNIS GRACILIS.**

Aletornis gracilis, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 258. — COUES, Key, 1872, p. 348.

A bird about the size of a woodcock (*Philohela minor*). From the same formation and locality, and now preserved in the Museum of Yale College.

16. **ALETORNIS BELLUS.**

Aletornis bellus, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 258. — COUES, Key, 1872, p. 349.

A still smaller species, probably belonging to a different genus. From the same locality, and also in the Yale Museum.

LAMELLIROSTRES (p. 677).

17. **CYGNUS PALOREGONUS.**

Cygnus paloregonus, COPE, Bull. U. S. Geol. Surv. Terr., iv, no. 2, May 3, 1878, p. 388.

Represented by numerous bones, especially by four metatarsals, two of which are nearly perfect, indicating a species very near those now existing, but apparently distinct. From the Pliocene of Oregon. Remains in Prof. Cope's Collection.

18. **BERNICLA HYPSIBATES.**

Anser hypsibates, COPE, Bull. U. S. Geol. Surv. Terr., iv, no. 2, May 3, 1878, p. 387.

Based upon a metatarsal bone lacking the hypotarsus, indicating a goose nearly related to *Bernicla canadensis*, but probably larger or with longer legs. From the Pliocene of Oregon. Remains in Prof. Cope's Collection.

STEGANOPODES (p. 718).

19. **SULA LOXOSTYLA.**

Sula loxostyla, COPE, Trans. Amer. Philos. Soc., xiv, Dec., 1870, p. 236. — COUES, Key, 1872, p. 349.

A gannet, not so large as the common living species (*S. bassana*), from the Miocene of North Carolina. The remains are preserved in Professor Cope's Collection.

20. **PHALACROCORAX IDAHENSIS.**

Graculus idahensis, MARSH, Am. Journ. Sci., xlix, Mar., 1870, p. 216. — COUES, Key, 1872, p. 349.

A typical cormorant, rather smaller than *P. carbo*. From the Pliocene of Idaho. Most of the known remains are deposited in the Yale Museum.

21. **PHALACROCORAX MACROPUS.**

Graculus macropus, COPE, Bull. U. S. Geol. Surv. Terr., iv, no. 2, May 3, 1878, p. 386.

From the Pliocene of Oregon, in which it appears to have been numerous; represented by various bones, those upon which the species is based being three nearly perfect metatarsals in the collection of Prof. Cope, indicating a bird somewhat larger than the living *Phalacrocorax dilophus*, and agreeing closely in size with *Ph. idahensis*.

LONGIPENNES (p. 732).

22. **PUFFINUS CONRADI.**

Puffinus conradii, MARSH, Am. Journ. Sci., xlix, Mar., 1872, p. 212. — COUES, Key, 1872, p. 350.

A shearwater about the size of *P. cinereus*. From the Miocene of Maryland, and now preserved in the Museum of the Philadelphia Academy.

PYGOPODES (p. 787).

23. **LOMVIA ANTIQUA.**

Catarractes antiquus, MARSH, Am. Journ. Sci., xlix, Mar., 1870, p. 213. — COUES, Key, 1872, p. 350.

A guillemot rather larger than the common murre (*L. troile*). From the Miocene of North Carolina. Deposited in the Philadelphia Academy.

24. **LOMVIA AFFINIS.**

Catarractes affinis, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 259. — COUES, Key, 1872, p. 350.

A species about as large as the preceding, and nearly related. From the Post-pliocene of Maine. The original specimen is in the Philadelphia Academy.

RATITÆ (p. 238).

25. **GASTORNIS GIGANTEUS.**

Diatryma gigantea, COPE, Proc. Phila. Acad., 1876, p. 11. — Rep. Surv. W. 100th Merid., iv, pt. ii, 1877, pp. 69–71, pl. xxxii, figg. 23–25.

From the Eocene of New Mexico, of the Wahsatch epoch; based upon a tarso-metatarsal bone lacking a part of the shaft and the external condyle. The species was of great size, the proximal end of the bone being nearly twice the diameter of that of the ostrich. "Its discovery introduced this group of Birds [*Ratitæ*] to the known faunæ of North America, and demonstrates that this continent has not been destitute of the gigantic forms of birds now confined to the southern hemisphere faunæ" (Cope). The proximal end of the bone is described as resembling the same part in the ostriches (*Struthionidæ*) and moas (*Dinornithidæ*); while the distal end, as far as that is preserved, is similar to that of *Gastornis* of the corresponding horizon in France.

B. — Cretaceous Birds.

The following synopsis is based upon that given in the appendix of Marsh's great work already cited ('Odontornithes'). The nine genera and nineteen species presented are supposed to be referable to one or the other of the two types exemplified by *Ichthyornis* and *Hesperornis* respectively; but, as many of them are still known only by remains so fragmentary that it is impossible to say whether they are *Odontotormæ* or *Odontolcæ*, an alphabetical arrangement of the genera is followed.

Most of the known remains of Cretaceous birds of North America have been discovered on the eastern slopes of the Rocky Mountains, in beds of middle Cretaceous age which have been termed by Marsh "Pteranodon beds," from the genus of toothless Pterodactyles found in them. These *Western* Cretaceous birds were all found in Kansas, excepting some from corresponding strata in Texas. The *Eastern* Cretaceous forms from the green-sand of New Jersey, all of which are distinct from the western ones, are from a higher horizon, representing a division of the upper Cretaceous. No jaws or teeth of these birds having been found, it is

impossible to say as yet whether or not they are odontornithic. All the deposits of Cretaceous age in North America, in which birds have been found, are marine, and the species appear to have all been aquatic.

26. **APATORNIS CELER.**

Ichthyornis celer, MARSH, Am. Journ. Sci., v, Jan., 1873, p. 74.

Apatornis celer, MARSH, Am. Journ. Sci., v, Feb., 1873, p. 162. — ID., *ibid.*, v, Mar., 1873, p. 230. — ID., *ibid.*, x, Nov., 1875, p. 404. — ID., Am. Nat., ix, Dec., 1875, p. 626. — ID., Geol. Mag., iii, Feb., 1876, p. 50. — WOODW., Pop. Sci. Rev., Oct., 1875, p. 349. — MARSH, Odont., 1880, p. 192, pll. xxviii–xxxiii.

A bird about the size of a pigeon, from the middle Cretaceous of Western Kansas; related to *Ichthyornis*. The two known specimens are preserved in the Yale Museum.

27. **BAPTORNIS ADVENUS.**

Baptornis advenus, MARSH, Am. Journ. Sci., xiv, July, 1877, p. 86. — ID., Journ. de Zool., vi, 1877, p. 387. — ID., Odont., 1880, p. 192, figg. 37-39.

Based upon a nearly perfect tarso-metatarsal, closely resembling the same part of *Hesperornis*, and indicating an aquatic bird about as large as a loon. From Western Kansas, in the same Cretaceous beds with *Odontornithes* and *Pteranodontia*. The type, and a second specimen referred to the same species, are preserved in the Museum at Yale College.

28. **GRACULAVUS VELOX.**

Graculavus velox, MARSH, Am. Journ. Sci., iii, May, 1872, p. 363. — ID., *ibid.*, v, Mar., 1873, p. 229. — ID., Odont., 1880, p. 194. — COUES, Key, 1872, p. 349.

A bird about two-thirds as large as a cormorant. The remains were found in the greensand of the middle marl bed, or upper Cretaceous, near Hornerstown, New Jersey, and are all preserved in the Museum of Yale College.

29. **GRACULAVUS PUMILUS.**

Graculavus pumilus, MARSH, Am. Journ. Sci., iii, May, 1872, p. 364. — ID., *ibid.*, v, Mar., 1873, p. 229. — ID., Odont., 1880, p. 195. — COUES, Key, 1872, p. 350.

A smaller species than the foregoing, from the same formation and locality. Remains also in the Yale Museum.

NOTE. Several western species, provisionally referred to the genus *Graculavus*, have since been identified with *Ichthyornis*, which see.

30. **HESPERORNIS REGALIS.** (See p. 63, fig. 15.)

Hesperornis regalis, MARSH, Am. Journ. Sci., iii, Jan., 1872, p. 56. — ID., *ibid.*, iii, May, 1872, p. 360. — ID., *ibid.*, x, Nov., 1875, p. 403. — ID., *ibid.*, xiv, July, 1877, p. 85, pl. v. — ID., Am. Nat., ix, Dec., 1875, p. 625. — ID., Geol. Mag., iii, Feb., 1876, p. 49, pl. ii. — ID., Odont., 1880, pp. 1–117, p. 195, pll. i–xx. — COUES, Key, 1872, p. 195. — WOODW., Pop. Sci. Rev., Oct., 1875, p. 337. — SEELEY, Journ. Geol. Soc., xxxii, 1876, p. 510. — HUXL., Pop. Sci. Monthly, x, 1876, pp. 215–218. — VOGT, Revue Scient., xvii, 1879, p. 247. — DANA, Man. Geol., 1880, pl. iv.

Reference to p. 238, *antea*, will show the essential characters of the order or subclass *Odontolcæ*, of which the present species is a type. *Hesperornis* may be tersely characterized as a gigantic diver, some six feet in length from the point of the bill to the end of the toes, standing over three feet high in the position represented in the above-cited figure. While the general configuration of the skeleton may be likened to that of a loon, the conformation of the sternum is ratite, like that of struthious birds, and the wings are rudimentary or abortive, only a remnant of a humerus being left; other struthious characters are noted in various parts of the skeleton: the jaws are long and furnished with sharp recurved teeth implanted in grooves, but the vertebræ are heterocœlous, or saddle-shaped, and the coccyx is short, as in ordinary birds: most of these characters separating this odontolcous type of *Odontornithes* sharply from both *Odontotormæ* and *Saururæ*. Comparison of the three Mesozoic genera, *Hesperornis*,

Ichthyornis and *Archæopteryx*, shows greater diversity from one another than that existing among all known birds of later geologic and of the present epoch.

The first remains of this now famous species were found by Prof. Marsh in November, 1870, in the yellow chalk of the Pteranodon beds, near the Smoky Hill river in Kansas. The type specimen was found in July, 1871, on the south bank of the same river, about twenty miles east of Fort Wallace, imbedded in gray calcareous shale. Many other remains have also been collected, representing in all some forty different individuals, all from the same geologic horizon in Western Kansas, and most of them near the locality of the original ones. They are all preserved in the Museum of Yale College.

31. **HESPERORNIS CRASSIPES.**

Lestornis crassipes, MARSH, Am. Journ. Sci., xi, June, 1876, p. 509.

Hesperornis crassipes, MARSH, Odont., 1880, p. 196, figg. 40 *a–d*, pll. vii, xvii.

Based upon a nearly complete skeleton from the yellow chalk of Western Kansas, indicating a bird considerably larger than *H. regalis*, and one that may prove to be generically distinct. Deposited in the Yale Museum.

32. **HESPERORNIS GRACILIS.**

Hesperornis gracilis, MARSH, Am. Journ. Sci., xi, June, 1876, p. 510. — ID., Odont., 1880, pp. 99, 197.

A third species, from the same horizon and locality, represented by two specimens, one of them a nearly complete skeleton. Deposited in the Yale Museum.

33. **ICHTHYORNIS DISPAR.**

Ichthyornis dispar, MARSH, Am. Journ. Sci., iv, Oct., 1872, p. 344. — ID., *ibid.*, v, Feb., 1873, p. 161. — ID., *ibid.*, Mar., 1873, p. 230. — COUES, Key, 1872, p. 350. — OWEN, Journ. Geol. Soc. Lond., xxxix, 1873, p. 520. — WOODW., Pop. Sci. Rev., Oct., 1875, p. 348. — MARSH, Am. Nat., ix, Dec., 1875, p. 625. — ID., Geol. Mag., iii, 1876, p. 49. — HUXL., Pop. Sci. Monthly, x, 1876, pp. 215–218. — MARSH, Journ. de Zool., iv, 1875, p. 494, pl. xv; vi, 1877, p. 385. — ID., Odont., 1880, pp. 119–183, 197, pll. xxi–xxvi.

This remarkable bird, forming a type of the whole group *Odontotormæ* (p. 237) of *Odontornithes*, with general characters of the skeleton like those of ordinary birds, yet with socketed teeth and biconcave vertebræ, was discovered in 1872 near the Solomon river in Northwestern Kansas, in the Pteranodon beds of the middle Cretaceous. It was about as large as a pigeon. The remains of about nine individuals, all from the same region, are preserved in the Museum at Yale College.

34. **ICHTHYORNIS AGILIS.**

Graculavus agilis, MARSH, Am. Journ. Sci., v, Mar., 1873, p. 230.

Ichthyornis agilis, MARSH, Odont., 1880, p. 197.

From the same horizon in Western Kansas, on Butte Creek, a tributary of the Smoky Hill river, where discovered in October, 1872. The remains are preserved in the Yale College Museum.

35. **ICHTHYORNIS ANCEPS.**

Graculavus anceps, MARSH, Am. Journ. Sci., iii, May, 1872, p. 364. — COUES, Key, 1872, p. 350. — MARSH, Am. Journ. Sci., v, Mar., 1873, p. 229. — ID., Odont., 1880, pp. 124, 198.

Resembling *I. dispar*, but with slenderer jaws and more teeth. The right lower jaw of the type specimen of *I. dispar* shows twenty-one distinct sockets. Discovered in November, 1870, in the gray shale of the middle Cretaceous, on the north fork of the Smoky Hill river in western Kansas, where other specimens have since been found. All are preserved at Yale.

36. **ICHTHYORNIS LENTUS.**

Graculavus lentus, MARSH, Am. Journ. Sci., xiv, Sept., 1877, p. 253.

Ichthyornis lentus, MARSH, Odont., 1880, p. 198.

Based upon part of a tarso-metatarsus from near Fort McKinney, Texas, in beds of middle Cretaceous age. Deposited in the Yale Museum.

37. **ICHTHYORNIS TENER.**

Ichthyornis tener, MARSH, Odont., 1880, p. 198, pl. xxx, fig. 8.

From the Pteranodon beds of the middle Cretaceous, Wallace County, Kansas; two specimens, secured in 1876, and now preserved at the Yale College Museum.

38. **ICHTHYORNIS VALIDUS.**

Ichthyornis validus, MARSH, Odont., 1880, p. 198, pl. xxx, figg. 11–14.

Discovered in 1877, in the yellow chalk of the middle Cretaceous, near Solomon River, in northwestern Kansas. The known specimens are deposited in the Museum of Yale College.

39. **ICHTHYORNIS VICTOR.** (See p. 64, fig. 16.)

Ichthyornis victor, MARSH, Am. Journ. Sci., xi, June, 1876, p. 511. — ID., Odont., 1880, p. 199, pll. xxvii–xxxiv. — DANA, Man. Geol., 1880, pp. 466–468, pl. v.

A species of the genus rather larger than a pigeon, of which more than forty specimens have been found in various localities in Kansas, all apparently from the same geological horizon in the middle Cretaceous. These are preserved in the Museum of Yale College.

40. **LAORNIS EDVARDSIANUS.**

Laornis edvardsianus, MARSH, Proc. Phila. Acad., Jan., 1870, p. 5. — ID., Am. Journ. Sci., xlix, Mar., 1870, p. 206. — ID. *ibid.*, v, Mar., 1873, p. 230. — A. MILNE-EDW., Rech. Ossem. Foss., ii, 1871, p. 540. — COUES, Key, 1872, p. 350. — MARSH, Odont., 1880, p. 199.

This species was nearly as large as a swan. The remains by which it is represented were found in the middle marl bed, of upper Cretaceous age, at Birmingham, New Jersey, and are now in the Museum of Yale College.

41. **PALÆOTRINGA LITORALIS.**

Palæotringa littoralis, MARSH, Proc. Phila. Acad., Jan., 1870, p. 5. — ID., Am. Journ. Sci., xlix, Mar., 1870, p. 208. — A. MILNE-EDW., Rech. Ossem. Foss., ii, 1871, p. 540. — COUES, Key, 1872, p. 349. — MARSH, Am. Journ. Sci., v, Mar., 1873, p. 229. — ID., Odont., 1880, p. 199.

A bird about as large as a curlew. The remains representing it were discovered in the green-sand of the upper Cretaceous, near Hornerstown, New Jersey, and are preserved in the collection at Yale College.

42. **PALÆOTRINGA VAGANS.**

Palæotringa vagans, MARSH, Am. Journ. Sci., iii, May, 1872, p. 365. — COUES, Key, 1872, p. 349. — MARSH, Am. Journ. Sci., v, Mar., 1873, p. 229.

From the same formation and locality as the last; of smaller size, being intermediate between the other two species of the genus. The specimens upon which this species is based are preserved in the Yale College Museum.

43. **PALÆOTRINGA VETUS.**

Scolopax, MORTON, Syn. Organic Remains of the Cret., U. S., 1834, p. 32. — HARLAN, Med. and Phys. Res., 1835, p. 280.

Palæotringa vetus, MARSH, Proc. Phila. Acad., Jan., 1870, p. 5. — ID., Am. Journ. Sci., xlix, Mar., 1870, p. 209. — A. MILNE-EDW., Rech. Ossem. Foss., ii, 1871, p. 540. — COUES, Key, 1872, p. 349. — MARSH, Am. Journ. Sci., v, Mar., 1873, p. 229. — ID., Odont., 1880, p. 200.

The first fossil bird of North America appears to have been noted by Dr. Morton in 1834, as that of a snipe-like species. The specimen, consisting of a femur imperfect at the upper extremity, was presented by S. W. Conrad to Dr. Harlan, who remarks that "the bone appears to be perfectly mineralized." It was found near Arneytown, New Jersey, in the lower marl bed of the Cretaceous formation. This same specimen (which meanwhile had been generally regarded as of a recent species, notwithstanding its condition and the position in which

it had been found) furnished Prof. Marsh the basis of his *Palæotringa vetus*, a smaller species than either of the others of this genus. The known remains are in the Philadelphia Academy.

44. **TELMATORNIS PRISCUS.**

Telmatornis priscus, MARSH, Proc. Phila. Acad., Jan., 1870, p. 5. — ID., Am. Journ. Sci., xlix, Mar., 1870, p. 210. — A. MILNE-EDW., Rech. Ossem. Foss., ii, 1871, p. 541. — COUES, Key, 1872, p. 349. — MARSH, Am. Journ. Sci., v, Mar., 1873, p. 229. — ID., Odont., 1880, p. 200.

A species about as large as the king rail (*Rallus elegans*); from the middle marl bed of the upper Cretaceous formation. The remains were found near Hornerstown, New Jersey, and are preserved in the Museum of Yale College.

45. **TELMATORNIS AFFINIS.**

Telmatornis affinis, MARSH, Proc. Phila. Acad., Jan., 1870, p. 5. — ID., Am. Journ. Sci., xlix, Mar., 1870, p. 211. — A. MILNE-EDW., Rech. Ossem. Foss. ii, 1871, p. 541. — COUES, Key, 1872, p. 349. — MARSH, Am. Journ. Sci., v, Mar., 1873, p. 229. — ID., Odont., 1880, p. 201.

The known remains are in the Yale Museum.

C. — Jurassic Birds.

The single representative of birds at present known from this formation is odontornithic.

46. **LAOPTERYX PRISCUS.**

Laopteryx priscus, MARSH, Am. Journ. Sci., xxi, Apr., 1881, p. 341.

From the upper Jurassic beds of Wyoming. The known remains are deposited in the Museum of Yale College.

The interest attaching to this fossil induces me to transcribe the original description: —

"The type specimen of the present species is the posterior portion of the skull, which indicates a bird rather larger than a blue heron (*Ardea Herodias*). The braincase is so broken that its inner surface is disclosed, and in other respects the skull is distorted, but it shows characteristic features. The bones of the skull are pneumatic. The occipital condyle is sessile, hemispherical in form, flattened and slightly grooved above. There is no trace of a posterior groove. The foramen magnum is nearly circular, and small in proportion to the condyle. Its plane coincides with that of the occiput, which is slightly inclined forward. The bones around the foramen are firmly co-ossified, but the supra-occipital has separated somewhat from the squamosals and parietals. Other sutures are more or less open. On each side of the condyle, and somewhat below its lower margin, there is a deep, rounded cavity, perforated by a pneumatic foramen.

"The cavity for the reception of the head of the quadrate is oval in outline, and its longer axis, if continued backward, would touch the outer margin of the occipital condyle. This cavity indicates that the quadrate had an undivided head. The braincase was comparatively small, but the hemispheres were well developed. They were separated above by a sharp mesial crest of bone. A low ridge divided the hemispheres from the optic lobes, which were prominent.

"The following measurements indicate the size of the specimen: —

"Width of skull across occiput (approximate)	24 mm
"Transverse diameter of occipital condyle	5 "
"Vertical diameter	4 "
"Width of foramen magnum	5 "
"Height	6 "
"Distance from occipital condyle to top of supra-occipital	11 "

"In its main features, the present specimen resembles the skull of the *Ratitæ*, more than that of any existing birds. Other parts of the skeleton will doubtless show still stronger reptilian characters.

"In the matrix attached to this skull, a single tooth was found, which most resembles the teeth of birds, especially those of *Ichthyornis*. It is probable that *Laopteryx* possessed teeth, and also biconcave vertebræ.

"The specimen here described, and others apparently of the same species, were found in the upper Jurassic of Wyoming Territory, in the horizon of the Atlantosaurus beds."

INDEX.

NOTE.—(1) Scientific names of birds consisting of two terms are entered but once, under the genus; as, *Turdus mustelinus*. (2) But vernacular names of two terms are entered twice; as, *Wood thrush*, and *Thrush, wood*. (3) Anatomical and other technical terms are fully indexed as occurring in Part II., where they are defined and explained; but not as occurring in Parts III. and IV., where they are simply used in describing birds. (4) Names of birds, both scientific and vernacular, are fully indexed as occurring in Parts III. and IV., but *usually* not as incidentally occurring in Parts I. and II. in illustration of the zoological and anatomical characters there noted. (5) Names merely appearing in the text, not as headings, are *usually* not indexed; many such, however, will be found, especially such as are not elsewhere formally treated. (6) Synonyms, both scientific and vernacular, are indexed. (7) Matters of field-work and taxidermy treated in Part I. are fully indexed by one or more leading words; as, *Insect pests*, and *Pests, insect*. (8) Names of persons mentioned or of authors quoted are not indexed. (9) The whole work is so fully indexed that the Index will serve as a glossary of the terminology of ornithology. (10) All the figures refer to pages.

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APPENDIX

EXHIBITING THE NOMENCLATURE OF THE AMERICAN ORNITHOLOGISTS' UNION CHECK-LIST IN COMPARISON WITH THAT OF THE KEY, AND INCLUDING DESCRIPTIONS OF ADDITIONAL SPECIES, ETC.

NOTE. In the Key List, the numbering is continuous, with few exceptions, and the letters *a*, *b*, etc., and the terms *bis*, *ter*, etc., indicate additions to the numeration of the Coues Check List of 1882, which was preserved in the Key, 1884. In the Union List the numeration is necessarily broken to make the comparison with the Key column, because the sequence of species in the Union List is different. In the latter, *a*, *b*, *c*, indicate subspecies; extralimital species have their respective numbers bracketed; and the daggers (†) indicate the numbers of the "Hypothetical" List.

COUES KEY, 1884.	UNION LIST, 1886.
1. Turdus migratorius.	761. Merula migratoria.
2. migratorius propinquus?	761*a*. migratoria propinqua.
3. confinis.	762. confinis.
4. iliacus.	[760.] Turdus iliacus.
5. nævius.	763. Hesperocichla nævia.
6. mustelinus.	755. Turdus mustelinus.
7. fuscescens.	756. fuscescens.
7*a*. fuscescens salicicola.	756*a*. fuscescens salicolus.
8. unalascæ.	759. aonalaschkæ.
9. unalascæ auduboni.	759*a*. aonalaschkæ auduboni.
10. unalascæ nanus.	759*b*. aonalaschkæ pallasii.
11. ustulatus.	758. ustulatus.
12. ustulatus aliciæ.	757. aliciæ.
00. [Not admitted in the Key.]	757*a*. aliciæ bicknelli.
13. Turdus ustulatus swainsoni.	758*a*. ustulatus swainsonii.
14. Oroscoptes montanus.	702. Oroscoptes montanus.
15. Mimus polyglottus.	703. Mimus polyglottus.
16. carolinensis.	704. Galeoscoptes carolinensis.
17. Harporhynchus rufus.	705. Harporhynchus rufus.
18. rufus longirostris.	706. longirostris.
19. curvirostris.	707. curvirostris.
20. curvirostris palmeri.	707*a*. curvirostris palmeri.
21. bendirii.	708. bendirei.
22. cinereus.	709. cinereus.
23. redivivus.	710. redivivus.
24. lecontii.	711. lecontei.

COUES KEY, 1884.	UNION LIST, 1886.
25. Harporhynchus crissalis.	712. Harporhynchus crissalis.
30. Cinclus mexicanus.	701. Cinclus mexicanus.
26. Saxicola œnanthe.	765. Saxicola œnanthe.
27. Sialia sialis.	766. Sialia sialis.
	766*a*. Sialia sialis azurea.

27 *bis*. *Add:* **Sialia sialis azurea.** AZURE BLUEBIRD. Similar to *S. sialis:* the blue of a greenish shade, and the tail upward of 3.00. Southern Arizona and southward. A slight variety, scarcely recognizable.

28. Sialia mexicana.	767. Sialia mexicana.
29. arctica.	768. arctica.
31. Cyanecula suecica.	[764. Cyanecula suecica.
32. Phylloscopus borealis.	747. Phyllopseustes borealis.
33. Regulus calendula.	749. Regulus calendula.
	750 obscurus.

33 *bis*. *Add:* **Regulus calendula obscurus.** DUSKY KINGLET. Resembling the common ruby-crown, but with darker and more plumbeous shade of the upper parts, and some slight differences in proportions. A dark insular form described from Guadalupe Island, Lower California. Since the publication of the Key, the A. O. U. Committee has decided to include "Lower California, with the islands naturally belonging thereto," in the "North American" avifauna, — a decision in which I concur. (Code, p. 14.)

34. Regulus satrapa	748. Regulus satrapa.
35. satrapa olivaceus?	748*a*. satrapa olivaceus.
36. Polioptila cœrulea.	751. Polioptila cærulea.
37. melanura.	753. californica.
38. plumbea.	752. plumbea.
39. Chamæa fasciata.	742. Chamæa fasciata.
39*a*. fasciata henshawi.	742*a*. fasciata henshawi.
40. Lophophanes bicolor.	731. Parus bicolor.
	000. [Not in the List.]

40 *bis*. *Add:* **Lophophanes bicolor texensis.** TEXAN TUFTED TITMOUSE. Paler than the last, with chestnut instead of black frontlet at base of crest; this chestnut corresponding in tint to that which suffuses the sides of the body. Tarsus 0.85; bill 0.45. Southern Texas. The Auk, Jan. 1887, p. 29.

41. Lophophanes inornatus.	733. Parus inornatus.
	733*a*. Parus inornatus griseus.

41 *bis*. *Add:* **Lophophanes inornatus griseus.** GRAY TITMOUSE. Said to differ from ordinary *inornatus* in rather larger size and decidedly grayer color. Wing 2.90; tail 2.55. Middle Province of the United States; Colorado, Utah, Nevada, New Mexico, and Arizona. Pr. U. S. Nat. Mus., v., 1882, p. 344.

	733*b*. Parus inornatus cineraceus.

41 *ter*. *Add:* **Lophophanes inornatus cineraceus.** ASHY TITMOUSE. Another alleged local race, described as even grayer above and paler below than *L. i. griseus*, with smaller bill, black in color. Lower California. Pr. U. S. Nat. Mus., vi., Oct. 1883, p. 154.

42. Lophophanes atrocristatus.	732. Parus atricristatus.
	000. [Not in the List.]

42 *bis*. *Add:* **Lophophanes atrocristatus castaneifrons.** CHESTNUT-FRONTED TITMOUSE. Resembling the last: upper parts plumbeous, faintly tinged with olive; under

parts pale ashy, washed with chestnut on the sides, with faint trace of the same on breast and crissum. Crest thin, an inch long, dark brown and ashy instead of black, and with a chestnut frontlet; lores white; bill black; feet dark plumbeous. Size of *P. bicolor*, the bill even larger. Wing 3.12; tail 2.95; tarsus 0.77; bill 0.42. Lately discovered in Bee County, Texas. The Auk, Jan. 1887, p. 28.

COUES KEY, 1884.	UNION LIST, 1886.
43. Lophophanes wollweberi.	734. Parus wollweberi.
44. Parus atricapillus.	735. atricapillus.
45. atricapillus septentrionalis.	735*a*. atricapillus septentrionalis.
46. atricapillus occidentalis.	735*b*. atricapillus occidentalis.
47. carolinensis.	736. carolinensis.
879. meridionalis.	[737.] meridionalis. [p. 334.)
48. montanus.	738. gambeli. (*New name*, List,
50. rufescens.	741. rufescens.
51. rufescens neglectus ?	741*a*. rufescens neglectus.
49. hudsonicus.	740. hudsonicus.
49*a*. hudsonicus evura	000. [Not admitted in the List.]
52. cinctus.	739. Parus cinctus obtectus.
53. Psaltriparus minimus.	743. Psaltriparus minimus.
53. minimus.	743*a*. minimus californicus.
	743*b*. minimus grindæ.

53 *bis*. *Add:* **Psaltriparus minimus grindæ**. GRINDA'S BUSH-TIT. *Adult:* Cap pale brown, lightening on sides of head into white on chin and throat; other under parts exactly as in *P. minimus*. Upper parts light plumbeous-gray, well contrasted with the brown of the nape. Bill and feet black. Wing 2.00; tail 2.30 graduated 0.50; bill 0.20. A slight local variation, combining to some extent the characters of Nos. 53 and 54. Lower California. Pr. U. S. Nat. Mus., vi., Oct. 1883, p. 155.

54. Psaltriparus plumbeus.	744. Psaltriparus plumbeus.
55. melanotis.	[745.] melanotis.
56. Auriparus flaviceps.	746. Auriparus flaviceps.
57. Sitta carolinensis.	727. Sitta carolinensis.
58. carolinensis aculeata.	727*a*. carolinensis aculeata.
59. canadensis.	728. canadensis.
60. pusilla.	729. pusilla.
61. pygmæa.	730. pygmæa.
62. Certhia familiaris.	726. Certhia familiaris americana.
62*a*. familiaris mexicana.	726*a*. familiaris mexicana.
63. Campylorhynchus brunneicapillus.	713. Campylorhynchus brunneicapillus.
64. affinis.	714. affinis.
65. Salpinctes obsoletus.	715. Salpinctes obsoletus.
	716. guadaloupensis.

65 *bis*. *Add:* **Salpinctes obsoletus guadalupensis**. GUADALUPE ROCK WREN. An insular race, differing slightly in the darker coloration, and somewhat in proportions. ♂, wing 2.60–2.75; tail 2.20–2.30; bill 0.59; tarsus 0.85 : ♀, a little smaller. Guadalupe Island, Lower California.

66. Catherpes mexicanus.	[717.] Catherpes mexicanus.
67. mexicanus conspersus.	717*a*. mexicanus conspersus.
67*a*. mexicanus punctulatus.	000. [Not admitted in the List.]

COUES KEY, 1884.	UNION LIST, 1886.
68. Thryothorus ludovicianus.	718. Thryothorus ludovicianus.
69. ludovicianus miamiensis.	718*a*. ludovicianus miamensis.
70. ludovicianus berlandieri.	000. [Not admitted in the List.]
71. bewicki.	719. Thryothorus bewickii.
72. bewicki leucogaster.	719*b*. bewickii bairdi.
73. bewicki spilurus ?	719*a*. bewickii spilurus.
	720. brevicaudus.

73 *bis*. *Add:* **Thryothorus brevicaudus**. Guadalupe Wren. Resembling *T. bewicki leucogaster* ("*bairdi*"), but apparently distinct. Above grayest-brown, grayest on the tail, brownest on the rump; wing-feathers obsoletely and tail-feathers distinctly cross-barred with dusky, the three outermost of the latter pale dull gray at the ends, with one or two broad dusky bars. A strong white superciliary stripe, below which a grayish brown loral and auricular stripe. Below, white, shaded into ashy on the belly and sides; the crissum with broad black bars. Wing 1.85–1.90; tail 1.80; bill 0.45–0.50; tarsus 0.70–0.75. Guadalupe Island, Lower California.

74. Troglodytes domesticus.	721. Troglodytes aëdon.
75. domesticus parkmani.	721*a*. aëdon parkmanii.
76. Anorthura troglodytes hiemalis.	722. hiemalis.
77. troglodytes pacificus.	722*a*. hiemalis pacificus.
78. troglodytes alascensis.	723. alascensis.
79. Telmatodytes palustris.	725. Cistothorus palustris.
80. palustris paludicola ?	000. [Not admitted in the List.]
81. Cistothorus stellaris.	724. Cistothorus stellaris.
82. Eremophila alpestris.	474. Otocoris alpestris.
83. alpestris leucolæma.	474*a*. alpestris leucolæma.
00. [Not admitted in the Key.]	474*b*. alpestris praticola
00. [Not admitted in the Key.]	474*c*. alpestris arenicola.
00. [Not admitted in the Key.]	474*d*. alpestris giraudi.
84. Eremophila alpestris chrysolæma.	474*e*. alpestris chrysolæma.
85. Alauda arvensis.	[473.] Alauda arvensis.
86. Motacilla alba.	[694.] Motacilla alba.
86*a*. ocularis.	[695.] ocularis.
87. Budytes flavus ?	696. Budytes flavus leucostriatus.
88. Anthus pratensis.	[698.] Anthus pratensis.
89. ludovicianus.	697. pensilvanicus.
	[699.] cervinus.

89 *bis*. *Add:* **Anthus cervinus**. Red-throated Pipit. *Adult:* Above, light grayish-brown, fully streaked with dusky, the streaks broadest and darkest on the back. Wings and tail dusky, the feathers edged with pale brown, the long inner secondaries with buff, and the ends of the middle and greater wing-coverts whitish; outer tail-feathers with much white on both webs, and next feather with a white spot at end of inner web. A pale and more or less buffy superciliary and malar stripe. Below, whitish, more or less suffused with fawn-color on the chin and throat, the throat, breast and sides broadly streaked or longitudinally spotted with brownish-black, aggregated into a stripe on each side of the throat; the chin, belly and vent immaculate. Bill black, with yellowish base of lower mandible; feet dark brown. Wing 3.36; tail 2.50; bill 0.45; tarsus 0.85. A species of extensive distribution in northerly parts of the Old World, probably occurring in Alaska, and accidental in California. Pr. U. S. Nat. Mus., vi., Oct. 1883, p. 156.

COUES KEY, 1884.	UNION LIST, 1886.
90. Neocorys spraguii.	700. Anthus spragueii.
91. Mniotilta varia.	636. Mniotilta varia.
92. varia borealis ?	000. [Not admitted in the List.]
93. Parula americana.	648. Compsothlypis americana.
94. nigrilora.	649. nigrilora.
95. Protonotaria citrea.	637. Protonotaria citrea.
96. Helmintherus vermivorus.	639. Helmitherus vermivorus.
97. swainsoni.	638. Helinaia swainsonii.
98. Helminthophila pinus.	641. Helminthophila pinus.
99. lawrencii ?	†20. lawrencei?
100. leucobronchialis ?	†21. leucobronchialis?
101. cincinnatiensis ?	†22. cincinnatiensis?
102. chrysoptera.	642. chrysoptera.
103. bachmani.[1]	640. bachmani.
104. luciæ.	643. luciæ.
105. virginiæ.	644. virginiæ.
106. ruficapilla.	645. ruficapilla.
000. [Not admitted in the Key.]	645*a*. ruficapilla gutturalis.
107. Helminthophila celata	646. celata.
108. celata lutescens.	646*a*. celata lutescens.
109. peregrina.	647. peregrina.
110. Peucedramus olivaceus.	651. Dendroica olivacea.
111. Dendrœca æstiva.	652. æstiva.
111*a*. vieilloti bryanti.[2]	653. bryanti castaneiceps.
112. virens.	667. virens.
113. occidentalis.	669. occidentalis.
114. townsendi.	668. townsendi.
115. chrysoparia	666. chrysoparia.
116. nigrescens.	665. nigrescens.
117. cœrulescens.	654. cærulescens.
118. cœrulea.	658. cærulea.
119. coronata.	655. coronata.
120. audubonì.	656. audubonì.
121. blackburnæ.	662. blackburniæ.
122. striata.	661. striata.
123. castanea.	660. castanea.
124. pennsylvanica.	659. pensylvanica.
125. maculosa.	657. maculosa.
126. tigrina.	650. tigrina.
127. discolor.	673. discolor.
128. graciæ.	664. graciæ.
129. dominica.	663. dominica.

[1] This rare bird has recently been rediscovered in Louisiana, Mr. C. S. Galbraith having taken a specimen near Lake Pontchartrain in 1886. (The Auk, Jan. 1887, p. 35.) Still another specimen, perhaps one of Audubon's types, has been found by Mr. William Brewster in the Lafresnaye collection of the Boston Society of Natural History. (The Auk, April, 1887, p. 165.)

[2] *D. bryanti* having been described as a variety of *D. vieilloti*, and then raised to specific rank, has been more lately split into two varieties, and that one which is found on the west coast of Mexico, and also in Lower California, has been named *castaneiceps*, from the rich chestnut head. It will probably turn out to be identical with *vieilloti* proper.

COUES KEY, 1884.	UNION LIST, 1886.
130. Dendrœca dominica albilora.	663*a*. Dendroica dominica albilora.
131. kirtlandi.	670. kirtlandi.
132. palmarum.	672. palmarum.
133. palmarum hypochrysea?	672*a*. palmarum hypochrysea.
134. pinus.	671. vigorsii.
000. [See Key, p. 308.]	†23. (Perissoglossa?) carbonata.
000. [See Key, p. 308.]	†24. montana.
135. Siurus auricapillus.	674. Seiurus aurocapillus.
136. nævius.	675. noveboracensis.
137. nævius notabilis?	675*a*. noveboracensis notabilis.
138. motacilla.	676. motacilla.
139. Oporornis agilis.	678. Geothlypis agilis.
140. formosa.	677. formosa.
141. Geothlypis trichas.	681. trichas.
000. [Not admitted in the Key.]	681*a*. trichas occidentalis.
	682. beldingi.

141 *bis*. *Add:* **Geothlypis beldingi**. BELDING'S YELLOW-THROAT. Adult ♂: Above nearly uniform olive-green, a little browner anteriorly; below, rich yellow, paler on the vent, tinged with brown on the flanks and sides. Black mask exactly as in *G. trichas*, but bordered behind for its whole extent with rich yellow. Wing 2.60; tail 2.70, graduated 0.50; bill 0.55. Lower California. Quite distinct from any other species in this list. Pr. U. S. Nat. Mus., v., Sept. 1882, p. 344.

142. Geothlypis philadelphia.	679. Geothlypis philadelphia.
143. macgillivrayi.	680. macgillivrayi.
144. Icteria virens.	683. Icteria virens.
145. virens longicauda.	683*a*. virens longicauda.
146. Myiodioctes mitratus.	684. Sylvania mitrata.
147. pusillus.	685. pusilla.
148. pusillus pileolatus.	685*a*. pusilla pileolata.
149. canadensis.	686. canadensis.
000. [Not admitted in Key.]	†25. Sylvania (?) microcephala.
150. Cardellina rubrifrons.	690. Cardellina rubrifrons.
151. Setophaga picta.	688. Setophaga picta.
	[689.] miniata.

151 *bis*. *Add:* **Setophaga miniata**. RED-BELLIED REDSTART. Dark bluish-ash above. A square patch of dark chestnut on the crown. Forehead and sides of head, with the whole fore-neck and sides of the jugulum, black; other under parts carmine red; lining of wings and under tail-coverts white; tibiæ plumbeous. Wing-feathers dusky; tail-feathers black with much white on the lateral one, and more restricted white areas on the next two. Sexes alike. Length 5.10; wing 2.50; tail 3.00; tarsus 0.75. Central America and Mexico to Texas. See Key, p. 313.

152. Setophaga ruticilla.	687. Setophaga ruticilla.
	[691.] Ergaticus ruber.

152 *bis*. *Add:* **Ergaticus rubra**. CARMINE FLYCATCHING WARBLER. Rich carmine red, obscured on the back; ear-coverts silvery-white; wing- and tail-feathers dusky, edged externally with reddish; larger inner wing-coverts rosy white. Sexes alike. Length 4.75; wing 2.40; the first quill about as long as the sixth; tail 2.50, graduated 0.20; bill small, parine in shape, but with bristly rictus; tarsus 0.75. A very beautiful species; Mexico to Texas. See Key, p. 313.

COUES KEY, 1884.	UNION LIST, 1886
	[692.] Basileuterus culicivorus.

152 *ter*. *Add:* **Basileuterus culicivorus**. Brasher's Flycatching Warbler. Above, greenish-ash, more olivaceous on the back and rump; below, yellow, tinged with rufous on the crissum. Top of head striped with black on each side, these stripes separating greenish-yellow or yellow areas; a dusky loral and postocular spot. Length 5.00; wing 2.40; tail 2.25, graduated 0.15; bill 0.50; tarsus 0.75. Central America and Mexico to Texas.

	[693.] Basileuterus belli.

152 *quater*. *Add:* **Basileuterus belli**. Bell's Flycatching Warbler. Above, olive-green; below, yellow, shaded with olive on the sides; wings edged with yellow and lined with olive. Crown and cheeks orange-brown; a broad yellow superciliary stripe, separated from its fellow by a black frontlet which extends more obscurely along the crown; the yellow stripe continued beyond the rufous of the crown. Bill black; feet yellowish. Length 5.10; wing 2.25; tail 2.50; graduated 0.33; bill 0.50; tarsus 0.80. Central America and Mexico to Texas.

153. Certhiola bahamensis.	635. Certhiola bahamensis.
	606. Euphonia elegantissima.

153 *bis*. *Add:* **Euphonia elegantissima**. Blue-headed Tanager. Adult ♂: Above, black with a purplish gloss; crown and nape blue; frontlet chestnut, bordered behind by a black line. Below, deep brownish-orange, the throat black. Lining of wings and inner edges of wing-feathers white. Bill black; feet light brown. Length 4.50; wing 2.50; tail 1.50. ♀: upper parts olive-green with blue cap and chestnut frontlet; below, olive-yellow, brightest in the middle of the belly; the throat pale reddish. Mexico to Texas. See Key, p. 317.

154. Pyranga rubra.	608. Piranga erythromelas.
155. æstiva.	610. rubra.
156. æstiva cooperi.	610*a*. rubra cooperi.
157. hepatica.	609. hepatica.
158. ludoviciana.	607. ludoviciana.
159. Hirundo erythrogastra horrerorum.	613. Chelidon erythrogaster.
160. Iridoprocne bicolor.	614. Tachycineta bicolor.
161. Tachycineta thalassina.	615. thalassina.
162. Petrochelidon lunifrons.	612. Petrochelidon lunifrons.
163. Cotile riparia.	616. Clivicola riparia.
164. Stelgidopteryx serripennis.	617. Stelgidopteryx serripennis.
165. Progne subis.	611. Progne subis.
166. Ampelis garrulus.	618. Ampelis garrulus.
167. cedrorum.	619. cedrorum.
168. Phainopepla nitens.	620. Phainopepla nitens.
169. Myiadestes townsendi.	754. Myadestes townsendi.
170. Vireo olivaceus.	624. Vireo olivaceus.
171. flaviviridis.	625. flavoviridis.
172. altiloquus barbatulus.	[623.] altiloquus barbatulus.
173. philadelphicus.	626. philadelphicus.
174. gilvus.	627. gilvus.
175. gilvus swainsoni?	000. [Not admitted in the List.]
176. flavifrons.	628. Vireo flavifrons.
177. solitarius.	629. solitarius.
	000. [Not in the List.]

COUES KEY, 1884.	UNION LIST, 1886.

177 *bis*. *Add:* **Vireo solitarius alticola**. Mountain Solitary Greenlet. Like *solitarius* proper, but larger, with stouter bill, and of darker colors. In *solitarius* the upper parts are olive-green, contrasting with the pure ash of the head ; in the new variety the upper parts are nearly uniform blackish-plumbeous, only tinged with olive on the back Wing 3.00–3.30 ; tail 2.25. Mountains of North Carolina. The Auk, Jan. 1886, p. 111.

178. Vireo solitarius cassini.	629*a*. Vireo solitarius cassinii.
179. solitarius plumbeus.	629*b*. solitarius plumbeus.
180. vicinior.	634. vicinior.
181. noveboracensis.	631. noveboracensis.
	000. [Not in the List.]

181 *bis*. *Add:* **Vireo noveboracensis maynardi**. Key West Greenlet. Coloration much as in the last, but grayer above and paler yellow below ; size and proportions as in *V. crassirostris*, the bill as large and stout as in the latter. Wing 2.20–2.50 ; tail 1.90–2.05 ; bill 0.55–0.65, its depth at the nostrils 0.18–0.20. Key West, Florida. The Auk, April, 1887, p. 148.

182. Vireo huttoni.	632. Vireo huttoni.
182*a*. huttoni stevensi.	632*a*. huttoni stephensi.
183. belli.	633. belli.
184. pusillus.	633*a*. belli pusillus.
185. atricapillus.	630. atricapillus.
186. Lanius borealis.	621. Lanius borealis.
187. ludovicianus.	622. ludovicianus.
188. ludovicianus excubitorides.	622*a*. ludovicianus excubitoroides.
189. Hesperophona vespertina.	514. Coccothraustes vespertina.
190. Pinicola enucleator.	515. Pinicola enucleator.
191. Pyrrhula cassini.	[516.] Pyrrhula cassini.
192. Passer domesticus.	000. [Not admitted in the List.]
193. montanus.	000. [Not admitted in the List.]
194. Carpodacus purpureus.	517. Carpodacus purpureus.
000. [Not admitted in the Key.]	517*a*. purpureus californicus.
195. Carpodacus cassini.	518. cassini.
196. frontalis.	519. frontalis.
197. frontalis rhodocolpus (?)	519*a*. frontalis rhodocolpus.
	520. amplus.

197 *bis*. *Add:* **Carpodacus amplus**. Guadalupe House Finch. A large dark insular form, resembling *C. frontalis* proper, but with darker tints, and of considerably larger size. ♂, wing 3.10–3.35 ; tail 2.60–2.90 ; bill 0.40–0.45 from the nostril, and the same in depth ; tarsus 0.75–0.85 : ♀ somewhat smaller. Guadalupe Island, Lower California.

198. Loxia leucoptera	522. Loxia leucoptera.
199. curvirostra americana	521. curvirostra minor.
200. curvirostra mexicana	521*a*. curvirostra stricklandi.
201. Leucosticte atrata.	525. Leucosticte atrata.
202. australis	526. australis.
203. tephrocotis.	524. tephrocotis.
204. tephrocotis litoralis.	524*a*. tephrocotis littoralis.
205. griseinucha.	523. griseonucha.
206. arctoa.	000. [Not admitted in the List.]
207. Ægiothus linaria.	528. Acanthus linaria.

COUES KEY, 1884.	UNION LIST, 1886.
208. Ægiothus linaria holboelli.	528*a*. Acanthus linaria holboellii.
000. [Not admitted in the Key.]	528*b*. linaria rostrata.
209. Ægiothus hornemanni.	527 hornemannii.
210. exilipes.	527*a*. hornemannii exilipes.
211. Linota flavirostris brewsteri?	†17. brewsterii.
212. Chrysomitris pinus.	533. Spinus pinus.
213. Astragalinus tristis.	529 tristis.
214. lawrencii.	531. lawrencei.
215. psaltria.	530. psaltria.
216. psaltria arizonæ.	530*a*. psaltria arizonæ.
217. psaltria mexicanus.	530*b*. psaltria mexicanus.
218. notatus.	[532.] notatus.
219. Plectrophanes nivalis.	534. Plectrophenax nivalis.
	535. hyperboreus.

219 *bis*. *Add:* **Plectrophanes hyperboreus**. Polar Snowflake. McKay's Snow Bunting. Adult ♂ in spring: Pure white, excepting the tips of the wings, which are black for about an inch and a half, and a small black spot on the end of the middle tail feather; bill dull brown, with blackish tip; feet black. In winter: washed with rusty brown on the crown, ear-coverts, throat, and rump; the bill yellowish with dusky tip. Wing 4.65; tail 3.10; bill 0.45; tarsus 0.90. A beautiful "snowflake," apparently quite distinct from the last, lately discovered in Alaska. Pr. U. S. Nat. Mus., vii., 1884, p. 68.

220. Centrophanes lapponicus.	536. Calcarius lapponicus.
221. pictus.	537. pictus.
222. ornatus.	538. ornatus.
223. Rhynchophanes maccowni.	539. Rhynchophanes mccownii.
224. Passerculus bairdi.	545. Ammodramus bairdii.
225. princeps.	541. princeps.
226. sandvicensis.	542. sandwichensis.
227. sandvicensis savana.	542*a*. sandwichensis savanna.
228. sandvicensis anthinus.	542*c*. sandwichensis bryanti.
229. sandvicensis alaudinus.	542*b*. sandwichensis alaudinus.
	543. beldingi.

229 *bis*. *Add:* **Passerculus beldingi**. Belding's Savanna Sparrow. "Similar to the darker form of *P. sandwichensis* (i. e. *bryanti*), but much darker, with decidedly heavier dark spotting on lower parts, the bill larger and more elongated." Salt marshes of the Pacific coast, from Santa Barbara south to Todos Santos Island, Lower California. According to the A. O. U. Committee, what ornithologists have been calling "*Passerculus anthinus*" includes two distinct forms, one of which is now called "*Ammodramus sandwichensis bryanti*," and the other is this *Passerculus beldingi*. *P.* "*bryanti*" is described from San Francisco Bay, as "differing from *P. sandwichensis alaudinus* in decidedly smaller size and much darker coloration of the upper parts. There is little probability that such attempted discriminations will survive the official etiquette of the present flutter in American Ornithology.

230. Passerculus rostratus.	544. Ammodramus rostratus.
231. guttatus.	544*a*. rostratus guttatus.
232. Pocœcetes gramineus.	540. Poocætes gramineus.
233. gramineus confinis.	540*a*. gramineus confinis.
234. Coturniculus passerinus.	546. Ammodramus savannarum passerinus.
235. passerinus perpallidus.	546*a*. savannarum perpallidus

COUES KEY, 1884.	UNION LIST, 1886.
236. Coturniculus henslowi.	547. Ammodramus henslowii.
237. lecontii.	548. leconteii.
238. Ammodramus maritimus.	550. maritimus.
239. maritimus nigrescens.	551. nigrescens.
240. caudacutus.	549. caudacutus.
241. caudacutus nelsoni.	549*a*. caudacutus nelsoni.
242. Melospiza lincolni.	583. Melospiza lincolni.
243. palustris.	584. georgiana.
244. fasciata.	581. fasciata.
245. fasciata fallax.	581*a*. fasciata fallax.
	581*b*. fasciata montana.

245 *bis*. *Add:* **Melospiza fasciata montana**. Mountain Song-Sparrow. Resembling *M. f. fallax*, and scarcely distinguishable. Upper parts umber-brown with gray margins of the feathers, giving a strong grayish cast to the plumage; the back streaked with blackish-brown, and the streaks of the under parts also of this color. This is the form occurring in the Great Basin at large. The Auk, July, 1884, p. 224.

246. Melospiza fasciata heermanni.	581*c*. Melospiza fasciata heermanni.
247. fasciata samuelis.	581*d*. fasciata samuelis.
248. fasciata guttata.	581*e*. fasciata guttata.
249. fasciata rufina.	581*f*. fasciata rufina.
250. cinerea.	582. cinerea.
251. Peucæa æstivalis.	575. Peucæa æstivalis.
252. æstivalis illinoënsis.	575*a*. æstivalis bachmanii.
253. æstivalis arizonæ.	576. arizonæ.
	577. mexicana.

253 *bis*. *Add:* **Peucæa mexicana**. Mexican Summer finch. Upper parts gray suffused with bay, streaked on most of the back with bold black bay-edged stripes; crown similar, rather darker, in smaller pattern of the markings and without lighter median line. Bend of wing yellow; coverts blackish, with broad grayish-bay edgings; flight-feathers dusky, several inner secondaries blackish, with firm light edgings. Tail-feathers dusky, with obsolete scarcely discernible cross-waves, the middle pair with paler edges their whole length, the lateral ones fading toward their ends. Under parts pale grayish-brown, blanching on the throat and abdomen, unstreaked excepting for a slight pair of black maxillary stripes. Bill dark corn-color; feet light brown. Length 6.30; wing 2.65; tail 2.80; tarsus 0.80. (Described from Mexican specimens.) Mexico to the Valley of the Lower Rio Grande in Texas; a late addition to our Fauna.

254. Peucæa cassini.	578. Peucæa cassini.
255. ruficeps	580. ruficeps.
256. ruficeps boucardi.	580*a*. ruficeps boucardi.
000. [See Key, p. 375.	580*b*. ruficeps eremœca.
257. Peucæa carpalis.	579. carpalis.
258. Amphispiza bilineata.	573. Amphispiza bilineata.
259. belli.	574. belli.
260 belli nevadensis.	574*a*. belli nevadensis.
261. Junco hiemalis.[1]	567. Junco hyemalis.
262. hiemalis aikeni.	566. aikeni.

[1] The snow-bird which breeds on the mountains of North Carolina has been named as a variety, *J. h. carolinensis*, but the characters adduced do not seem satisfactory. The Auk, Jan. 1886, p. 108.

COUES KEY, 1884.	UNION LIST, 1886.
262*a*. Junco hiemalis connectens.	000. [Not admitted in the List.]
263. hiemalis oregonus.	567*a*. Junco hyemalis oregonus.
264. hiemalis annectens.	568. " annectens.
265. hiemalis caniceps.	569. caniceps.
266. hiemalis dorsalis.	570*a*. cinereus dorsalis.
267. hiemalis cinereus.	570. cinereus palliatus.
	571. bairdi.

267 *bis*. *Add:* **Junco hiemalis bairdi.** BAIRD'S SNOW-BIRD. Head and neck ashy-gray, paler on throat, tinged on hind-head with brown, the lores distinctly blackish. Back, scapulars and adjoining wing-feathers pale rufous-brown, tinged with olivaceous; rump and upper tail-coverts, with the lesser, middle, and outer wing-coverts grayish-olive; inner webs of tertials dusky; primaries gray, edged with paler, the outermost with white; outer tail-feather mostly white, two next with white in diminishing amount. Jugulum pale buffy-gray, contrasting with the white of the abdomen; sides and flanks cinnamon-buff; crissum dull whitish. Upper mandible dark brown, lower yellow; iris yellow; feet pale brown. Wing 2.80; tail 2.75; bill 0.40; tarsus 0.80 A form lately discovered in Lower California, resembling a bright-colored ♀ *J. oregonus*, presenting the peculiar combination of "pink" sides with yellow eyes and under mandible. Pr. U. S. Nat. Mus., vi., Oct. 1883, p. 155.

	572. Junco insularis

267 *ter*. *Add:* **Junco insularis.** GUADALUPE SNOW-BIRD. Resembling the so-called *J. annectens;* darker, and with somewhat different proportions. Crown and nape dark slate; lower tail-coverts dusky, the feathers edged with whitish; lores blackish. Wings and tail relatively short: wing 2.55–2.85; tail 2.30–2.60; bill 0.37 long, 0.27 deep. (In *annectens*, etc., wing and tail about 3.00.) Added to our Fauna by the inclusion of Guadalupe Island.

268. Spizella monticola.	559. Spizella monticola.
	559*a*. monticola ochracea.

268 *bis*. *Add:* **Spizella monticola ochracea.** WESTERN TREE SPARROW. Like the last: above, paler, with sparser, sharper and narrower dorsal streaks, sides and throat more ochraceous. Washington Territory. Bull. Nutt. Orn. Club, Oct. 1882, p. 228.

269. Spizella domestica.	560. Spizella socialis.
270. domestica arizonæ.	560*a*. socialis arizonæ.
271. agrestis.	563. pusilla.
	000. [Not admitted in the List.]

271 *bis*. *Add:* **Spizella agrestis arenacea.** TEXAN FIELD SPARROW. Like *S. agrestis*, but with the rufous replaced by brownish-ash; slightly larger, with longer tail and somewhat stouter bill. Wing 2.50; tail 2.90; culmen 0.35. A form lately described as migratory, or perhaps a winter resident, in Southern Texas. The Auk, April, 1886, p. 248.

	564. Spizella wortheni.

271 *ter*. *Add:* **Spizella wortheni.** WORTHEN'S FIELD-SPARROW. Resembling *S. agrestis*. Much less rufous, with broader black dorsal streaks, no rufous auricular streak nor lateral pectoral spot, a distinct white eye-ring, and slenderer bill. Wing 2.70; tail 2.50; bill 0.40; tarsus 0.70. Western Texas and New Mexico. Apparently a good species, approaching *S. atrigularis* in some respects, especially the coloration of the upper parts. Pr. U. S. Nat. Mus., vii., 1884, p. 259.

272. Spizella pallida.	561. Spizella pallida.
273. breweri.	562. breweri.
274. atrigularis.	565. atrigularis.

COUES KEY, 1884.	UNION LIST, 1886.
275. Zonotrichia albicollis.	558. Zonotrichia albicollis.
276. leucophrys.	554. leucophrys.
277. leucophrys intermedia.	555. intermedia.
278. gambeli.	556. gambeli.
279. coronata.	557. coronata.
280. querula.	553. querula.
281. Chondestes grammica.	552. Chondestes grammacus.
282. Passerella iliaca.	585. Passerella iliaca.
283. iliaca unalascensis.	585*a*. iliaca unalaschcensis.
284. iliaca schistacea.	585*c*. iliaca schistacea.
285. iliaca megarhyncha.	585*b*. iliaca megarhyncha.
286. Calamospiza bicolor.	605. Calamospiza melanocorys.
287. Spiza americana.	604. Spiza americana.
288. townsendi.	†18. townsendii.
289. Zamelodia ludoviciana.	595. Habia ludoviciana.
290. melanocephala.	596. melanocephala.
291. Guiraca cœrulea.	597. Guiraca cærulea.
292. Passerina ciris.	601. Passerina ciris.
293. versicolor.	600. versicolor.
294. amœna.	599. amœna.
295. cyanea.	598. cyanea.
296. Spermophila moreleti.	602. Sporophila morelleti.
297. Phonipara zena.	603. Euethea bicolor.
298. Pyrrhuloxia sinuata.	594. Pyrrhuloxia sinuata.
299. Cardinalis virginianus.	593. Cardinalis cardinalis.
	593*a*. cardinalis superbus.

299 *bis*. *Add:* **Cardinalis virginianus superbus**. ARIZONA CARDINAL. Like the last, but larger, and the female more richly colored. ♂, wing 4.10; tail 5.00; tarsus 1.05; bill along culmen 0.85; its depth at base 0.70: ♀ smaller. Arizona; hardly recognizable. The Auk, Oct. 1885, p. 344.

300. Cardinalis virginianus igneus.	593*b*. Cardinalis cardinalis igneus.
301. Pipilo erythrophthalmus.	587. Pipilo erythrophthalmus.
302. erythrophthalmus alleni.	587*a*. erythrophthalmus alleni.
303. maculatus oregonus.	588*b*. maculatus oregonus.
304. maculatus arcticus.	588. maculatus arcticus.
305. maculatus megalonyx.	588*a*. maculatus megalonyx.
	589. consobrinus.

305 *bis*. *Add:* **Pipilo maculatus consobrinus**. GUADALUPE TOWHEE. Adult ♂: Head, neck, throat, and upper parts black: white on outer webs of scapulars usually bordered with black; two well-defined white wing-bars; inner secondaries and a middle portion of the primaries narrowly edged with white; two or three lateral tail-feathers with terminal white patch. Below white, with chestnut sides and buff crissum. ♀ similar, but dull-brownish black where the male is black, and smaller white tail-spots. ♂, wing 3.10–3.25; tail 3.50–3.75: ♀ somewhat less. An insular race, one of many into which the very variable *P. maculatus* is divisible. Guadulupe Island, Lower California.

306. Pipilo fuscus mesoleucus.	591. Pipilo fuscus mesoleucus.
307. fuscus albigula.	591*a*. fuscus albigula.
308. fuscus crissalis.	591*b*. fuscus crissalis.

COUES KEY, 1884.	UNION LIST, 1886.
309. Pipilo aberti.	592. Pipilo aberti.
310. chlorurus.	590. chlorurus.
311. Embernagra rufovirgata.	586. Embernagra rufivirgata
312. Dolichonyx oryzivorus.	494. Dolichonyx oryzivorus.
000. [Not admitted in the Key.]	494*a*. oryzivorus albinucha.
313. Molothrus ater.	495. Molothrus ater.
314. ater obscurus.	495*a*. ater obscurus.
315. æneus.	496. æneus.
316. Agelæus phœniceus.	498. Agelaius phœniceus.
317. phœniceus gubernator.	499. gubernator.
318. tricolor.	500. tricolor.
319. Xan'hocephalus icterocephalus.	497. Xanthocephalus xanthocephalus.
320. Sturnella magna.	501. Sturnella magna.
321. magna mexicana.	501*a*. magna mexicana.
322. neglecta.	501*b*. magna neglecta.
323. Icterus vulgaris.	[502.] Icterus icterus.
324. spurius.	506. spurius.
325. spurius affinis.	000. [Not admitted in the List.]
326. galbula.	507. Icterus galbula.
327. bullocki.	508. bullocki.
328. cucullatus.	505. cucullatus.
	505*a*. cucullatus nelsoni.

328 *bis*. *Add:* **Icterus cucullatus nelsoni**. ARIZONA HOODED ORIOLE. A paler-colored race, in which the yellow is not supposed to become orange or flame-color, from Arizona, California, and southward to Mazatlan. The distinction is trivial, hardly indicating a geographical race. The description in the Key, p. 409, covers both this and the true *cucullatus*, which latter occurs in Texas and southward.

329. Icterus parisorum.	504. Icterus parisorum.
330. melanocephalus auduboni.	503. audubonii.
331. Scolecophagus ferrugineus.	509. Scolecophagus carolinus.
332. cyanocephalus.	510. cyanocephalus.
333. Quiscalus macrurus.	512. Quiscalus macrourus.
334. major.	513. major.
335. purpureus.	511. quiscula.
336. purpureus æneus.	511*b*. quiscula æneus.
337. purpureus aglæus.	511*a*. quiscula aglæus.
338. Corvus corax.	486. Corvus corax sinuatus.
339. cryptoleucus.	487. cryptoleucus.
340. frugivorus.	488. americanus.
341. frugivorus floridanus.	488*a*. americanus floridanus.
342 caurinus.	489. caurinus.
343. maritimus.	490. ossifragus.
344. Picicorvus columbianus.	491. Picicorvus columbianus.
345. Gymnocitta cyanocephala.	492. Cyanocephalus cyanocephalus.
346. Psilorhinus morio.	000. [Not admitted in the List.]
347. Pica rustica hudsonica.	475. Pica pica hudsonica.
348. nuttalli.	476. nuttalli.
349. Cyanocitta cristata.	477. Cyanocitta cristata.

COUES KEY, 1884.	UNION LIST, 1886.
349*a*. Cyanocitta cristata florincola.	477*a*. Cyanocitta cristata florincola.
350. stelleri.	478. stelleri.
351. stelleri annectens.	000. [Not admitted in the List.]
353 stelleri frontalis.	478*a*. Cyanocitta stelleri frontalis.
352. stelleri macrolopha.	478*b*. stelleri macrolopha.
354. Aphelocoma floridana.	479. Aphelocoma floridana.
355. floridana woodhousii.	480. woodhousei.
356. floridana californica.	481. californica.
	000. [Not admitted in the List.]

356 *bis*. *Add:* **Aphelocoma floridana insularis**. Santa Cruz Jay. — Above, dark azure blue, including exposed surface of wing- and tail-feathers, this color deepest on the crown, and extending on the sides of the head and well down on the neck and breast; the back dark sepia brown. A white superciliary line; a black loral and auricular spot. Feathers of throat and breast ashy-white edged with blue; crissum blue; other under parts dull white. Wing 5.35; tail 6.25; tarsus 1.80; bill 1.25. Santa Cruz Island, one of the Santa Barbara group, off the Coast of California. The Auk, Oct. 1886, p. 452.

357. Aphelocoma ultramarina arizonæ.	482. Aphelocoma sieberii arizonæ.
358. Xanthura luxuriosa.	483. Xanthoura luxuosa.
359. Perisoreus canadensis.	484. Perisoreus canadensis.
360. canadensis fumifrons.	484*b*. canadensis fumifrons.
000. [Not admitted in the Key.]	484*c*. canadensis nigricapillus.[1]
361. Perisoreus canadensis obscurus.	485. obscurus.
362. canadensis capitalis.	484*a*. canadensis capitalis.
363. Sturnus vulgaris.	[493.] Sturnus vulgaris.
364. Pitangus derbianus.	449. Pitangus derbianus.
364 *bis*. Myiozetetes texensis.	[450.] Myiozetetes texensis.
365. Myiodynastes luteiventris.	451. Myiodynastes luteiventris.
366. Milvulus tyrannus.	[442.] Milvulus tyrannus.
367. forficatus.	443. forficatus.
368. Tyrannus carolinensis.	444. Tyrannus tyrannus.
369. dominicensis.	445. dominicensis.
370. verticalis.	447. verticalis.
371. vociferans.	448. vociferans.
372. melancholicus couchi.	446. melancholicus couchii.
373. Myiarchus crinitus.	452. Myiarchus crinitus.
880. crinitus cooperi.	453*a*. mexicanus magister.
374. crinitus erythrocercus.	453. mexicanus.
375. cinerescens.	454. cinerascens.
376. lawrencii.	[455.] lawrenceii.
000. [Not admitted in the Key.]	455*a*. lawrencei olivascens.
377. Sayiornis sayi.	457. Sayornis saya.
378. nigricans.	458. nigricans.
379. fuscus.	456. phœbe.
380. Contopus borealis.	459. Contopus borealis.
381. pertinax.	460. pertinax.

[1] An alleged variety, said to differ from the true *canadensis* in altogether darker coloration, blacker crown, black auriculars, less extensive white front, and more marked contrast of the white and dark areas of the head and neck. Probably inhabits the coast region of Labrador, and most likely is only a specimen a little darker than usual. Pr. U. S. Nat. Mus., v., 1882, p. 15.

COUES KEY, 1884.	UNION LIST, 1886.
382. Contopus virens.	461. Contopus virens.
383. virens richardsoni.	462. richardsonii.
384. Empidonax acadicus.	465. Empidonax acadicus.
385. trailli.	466*a*. pusillus traillii.
386. pusillus.	466. pusillus.
387. minimus.	467. minimus.
388. flaviventris.	463. flaviventris.
389. flaviventris difficilis?	464. difficilis.
390. hammondi.	468. hammondi.
391. obscurus.	469. obscurus.
392. Mitrephanes fulvifrons pallescens.	470*a* fulvifrons pygmæus.
	470. fulvifrons.

392 *bis*. *Add:* **Mitrephanes fulvifrons**. FULVOUS FLYCATCHER. Specimens of the true *fulvifrons*, differing from the Arizona form in much heavier fulvous coloration, and agreeing with Giraud's type, are said to be found N. to Texas.

393. Ornithium imberbe.	472. Ornithion imberbe.
000. [Not admitted in the Key.]	472*a*. imberbe ridgwayi.
394. Pyrocephalus rubineus mexicanus.	471. Pyrocephalus rubineus mexicanus.
395. Nyctidromus albicollis.	419. Nyctidromus albicollis.
396. Antrostomus carolinensis.	416. Antrostomus carolinensis.
397. vociferus.	417. vociferus.
881. vociferus arizonæ.	417*a*. vociferus arizonæ.
398. Phalænoptilus nuttalli.	418. Phalænoptilus nuttalli.
	000. [Not admitted in the List.]

398 *bis*. *Add:* **Phalænoptilus nuttalli nitidus**. FROSTED POOR-WILL. Similar to the last, but with the dark markings of the upper parts fewer and sharper on a much paler ground, and the crossbars on the under parts finer and paler. Described as a bleached desert race from Texas and Arizona. The Auk, April, 1887. p. 147.

399. Chordediles popetue.	420. Chordeiles virginianus.
400. popetue henryi.	420*a* virginianus henryi.
401 popetue minor.	420*b*. virginianus minor.
402. acutipennis texensis.	421. texensis.
403. Panyptila saxatilis.	425. Micropus melanoleucus.
404. Nephœcetes niger borealis.	422. Cypseloides niger.
405. Chætura pelasgica.	423. Chætura pelagica.
406. vauxi.	424. vauxi.
407. Basilinna xantusi.	440. Basilinna xantusi.
408. Eugenes fulgens.	426. Eugenes fulgens.
	427. Cœligena clemenciæ.

408 *bis*. *Add:* **Cœligena clemenciæ**. BLUE-THROATED HUMMING-BIRD. Bill longer than head, straight; wings long and ample; tail large, rounded, with broad feathers; tarsi feathered; sexes unlike. ♂: above, bronzy-green; below, ashy-gray, the feathers more or less tipped with green. A white stripe behind the eye. Gorget metallic azure blue. Tail black, the two outermost feathers tipped with white. Upper mandible blackish, lower flesh-colored. Length 5.40; extent 7.50; wing 3.10; tail 1.90; culmen from nostril 0.88. A fine large species lately found in Southern Arizona. The Auk, Jan. 1885, p. 85.

409. Trochilus colubris.	428. Trochilus colubris.
410. alexandri	429. alexandri.

COUES KEY, 1884.	UNION LIST, 1886.
411. Selasphorus rufus.	433. Trochilus rufus.
412. alleni.	434. alleni.
413. platycercus.	432. platycercus.
414. Calypte annæ.	431. anna.
415. costæ.	430. costæ.
416. Atthis heloisæ.	435. heloisa.
417. Stellula calliope.	436. calliope.
418. Calothorax lucifer.	437. lucifer.
419. Amazilia fuscocaudata.	438. Amazilia fuscicaudata.
420. cerviniventris.	439. cerviniventris.
421. Iache latirostris.	441. Iache latirostris.
422. Trogon ambiguus.	[389.] Trogon ambiguus.
423. Ceryle alcyon.	390. Ceryle alcyon.
424. americana cabanisi.	391. cabanisi.
425. Crotophaga ani.	[383.] Crotophaga ani.
426. sulcirostris.	384. sulcirostris.
427. Geococcyx californianus.	385. Geococcyx californianus.
428. Coccygus erythrophthalmus.	388. Coccyzus erythrophthalmus.
429. americanus.	387. americanus.
430. seniculus.	386. minor.
431. Campephilus principalis.	392. Campephilus principalis.
432. Hylotomus pileatus.	405. Ceophlœus pileatus.
433. Picus borealis.	395. Dryobates borealis.
434. scalaris.	396. scalaris.
435. scalaris nuttalli.	397. nuttalli.
436. scalaris lucasanus.	396*a*. scalaris lucasanus.
437. stricklandi.	398. stricklandi.
438. villosus.	393. villosus.
438*a*. villosus major.	393*a*. villosus leucomelas.
438*c*. villosus minor.	393*b*. villosus audubonii.
439. villosus harrisi.	393*c*. villosus harrisii.
440. pubescens.	394. pubescens.
441. pubescens gairdneri.	394*a*. pubescens gairdnerii.
442. Xenopicus albolarvatus.	399. Xenopicus albolarvatus.
443. Picoides arcticus.	400. Picoides arcticus.
444. americanus.	401. americanus.
	401*a*. Picoides americanus alascensis.

444 *bis. Add:* **Picoides americanus alascensis.** Alaskan Three-toed Woodpecker. Resembling the last: back more broadly barred with white, the bars more or less confluent; the white postocular stripe more distinct; the dark bars of the sides narrower. Alaska and northern British America. The Auk, April, 1884, p. 165.

445. Picoïdes americanus dorsalis.	401*b*. Picoides americanus dorsalis.
446. Sphyrapicus varius.	402. Sphyrapicus varius.
447. varius nuchalis.	402*a*. varius nuchalis.
448. varius ruber.	403. ruber.
449. thyroïdes.	404. thyroideus.
450. Centurus carolinus.	409. Melanerpes carolinus.
451. aurifrons.	410. aurifrons.
452. uropygialis.	411. uropygialis.

COUES KEY, 1884.	UNION LIST, 1886.
453. Melanerpes erythrocephalus.	406. Melanerpes erythrocephalus.
454. formicivorus bairdii.	407. formicivorus bairdi.
455. formicivorus angustifrons.	407*a*. formicivorus angustifrons.
456. Asyndesmus torquatus.	408. torquatus.
457. Colaptes auratus.	412. Colaptes auratus.
458. chrysoïdes.	414. chrysoides.
459. mexicanus.	413. cafer!
000. [Not admitted in the Key.]	413*a*. cafer saturatior.[1]
	415. rufipileus.

459 *bis*. *Add:* **Colaptes mexicanus rufipileus.** GUADALUPE FLICKER. Resembling *C. mexicanus:* terminal black of the tail broader, occupying 2.50 instead of about 2.00 inches. Rump of a pale pinkish shade instead of pure white. Crown cinnamon, becoming tawny anteriorly, instead of grayish. Wings and tail much shorter; bill longer. Wing 5.90–6.25; tail 4.75–5.25; bill 1.35–1.60. An insular form approaching *C. chrysoides* in some respects, as the color of the crown. Guadalupe Island, Lower California.

460. Conurus carolinensis.	382. Conurus carolinensis.
461. Aluco flammeus pratincola.	365. Strix pratincola.
462. Bubo virginianus.	375. Bubo virginianus.
000. [Not admitted in the Key.]	375*a*. virginianus subarcticus.
463. Bubo virginianus arcticus.	375*b*. virginianus arcticus.
464. virginianus pacificus.	375*c*. virginianus saturatus.
465. Scops asio.	373. Megascops asio.
466. asio kennicotti.	373*d*. asio kennicottii.
466*a*. asio bendirii.	373*c*. asio bendirei.
467. asio maxwellæ.	373*e*. asio maxwelliæ.
468. asio maccalli.	373*b*. asio mccallii.
469. asio floridanus.	373*a*. asio floridanus.
470. trichopsis?	373*f*. asio trichopsis.
471. flammeola.	374. flammeolus.
472. Asio wilsonianus.	366. Asio wilsonianus.
473. accipitrinus.	367. accipitrinus
474. Strix cinerea.	370. Ulula cinerea.
475. cinerea lapponica.	[370*a*]. cinerea lapponica.
476. nebulosa.	368. Syrnium nebulosum.
477 nebulosa alleni.	368*a*. nebulosum alleni.
478. occidentalis.	369. occidentale.
479. Nyctea scandiaca.	376. Nyctea nyctea.
480. Surnia funerea.	377*a*. Surnia ulula caparoch
481. funerea ulula.	[377.] ulula.
482. Nyctala tengmalmi richardsoni.	371. Nyctala tengmalmi richardsoni.
483. acadica.	372. acadica.
484. Glaucidium gnoma.	379. Glaucidium gnoma.
485. ferrugineum.	380. phalœnoides.
486. Micrathene whitneyi.	381. Micrathene whitneyi.
487. Speotyto cunicularia hypogæa.	378. Speotyto cunicularia hypogæa.
488. cunicularia floridana.	378*a*. cunicularia floridana.

[1] An alleged dark-colored form occurring on the North West coast, from the Columbia River to Sitka, — a region of heavy rain-fall, where the tendency of the whole *ornis* is to acquire heavier coloration. See Pr. Biol. Soc. Washn., ii., Apr. 1884, p. 90.

COUES KEY, 1884.	UNION LIST, 1886.
489. Circus cyaneus hudsonius.	331. Circus hudsonius.
490. Rostrhamus sociabilis plumbeus.	330. Rostrhamus sociabilis.
491. Ictinia subcœrulea.	329. Ictinia mississippiensis.
492. Elanus glaucus.	328. Elanus leucurus.
493. Elanoïdes forficatus.	327. Elanoides forficatus.
494. Accipiter fuscus.	332. Accipiter velox.
495. cooperi.	333. cooperi.
496. Astur atricapillus.	334. atricapillus.
497. atricapillus striatulus?	334*a*. atricapillus striatulus.
498. Falco sacer.	354*a*. Falco rusticolus gyrfalco.
499. sacer obsoletus.	354*b*. rusticolus obsoletus.
500. islandicus.	354. rusticolus.
501. candicans.	353. islandus.
502. mexicanus.	355. mexicanus.
503. peregrinus.	356. peregrinus anatum.
504. peregrinus pealii.	356*a*. peregrinus pealei.
505. columbarius.	357. columbarius.
506. columbarius suckleyi?	357*a*. columbarius suckleyi.
507. columbarius richardsoni.	358. richardsonii.
508. sparverius.	360. sparverius.
509. sparverius isabellinus ?	000. [Properly omitted from the List.]
510. sparverioïdes.	[361.] Falco sparverioides.
511. fusciccerulescens.	359. fusco-cœrulescens.
535. Polyborus auduboni.	362. Polyborus cheriway.
	363. lutosus.

535 *bis*. *Add:* **Polyborus lutosus.** Guadalupe Caracara. As stated in the Key, p. 540, this species is quite distinct, nearly the whole plumage being barred. The diagnostic marks are tabulated by its describer as follows: "Scapulars plain dusky brown. Tibiæ and flanks light *isabella*-color, barred with dark brown. Wing coverts (middle and greater) marked with wide bars of brown and pale *isabella*-color, of equal width. Tail-coverts and rump with broad bars of light *isabella*-color and grayish-brown. Tail with broad bars of pale *isabella*-color and grayish-brown, separated by zigzag lines of dusky. Abdomen *isabella*-color, with small sagittate bars of dark brown." Wing 15.00–16.50; tail 10.50–11.50; bill 1.25–1.35; tarsus 3.50–3.75. Guadalupe Island, Lower California.

512. Buteo unicinctus harrisi.	335. Parabuteo unicinctus harrisi
513. albocaudatus.	341. Buteo albicaudatus.
514. cooperi?	†14. cooperi.
515. harlani.	338. harlani.
516. borealis.	337. borealis.
517. borealis calurus.	337*b*. borealis calurus.
518. borealis lucasanus.	337*c*. borealis lucasanus.
519. borealis krideri.	337*a*. borealis kriderii.
520. lineatus.	339. lineatus.
	339*a*. lineatus alleni.

520 *bis*. *Add:* **Buteo lineatus alleni.** Florida Red-Shouldered Hawk. As stated in the Key, p. 546, there is much variation in size, Florida and Gulf specimens being very small. Such examples, having the wing 12.50 or less, tail 8.00 or less, etc., in the male, have received the above name. Pr. U. S. Nat. Mus., vii., Jan. 1885, p. 514.

COUES KEY, 1884.	UNION LIST, 1886.
521. Buteo lineatus elegans.	339*b*. Buteo lineatus elegans.
522. abbreviatus.	340. abbreviatus.
523. swainsoni.	342. swainsoni.
000. [Not admitted in the Key.]	[336.] buteo.
524. Buteo pennsylvanicus.	343. latissimus.
882. brachyurus.	[344.] brachyurus.
883. fuliginosus.	†15. fuliginosus.
000. [Not admitted in the Key.]	[347.] Archibuteo lagopus.
525. Archibuteo lagopus sancti-johannis.	347*a*. lagopus sancti-johannis.
526. ferrugineus.	348. ferrugineus.
527. Asturina plagata.	346. Asturina plagiata.
528. Urubitinga anthracina.	345. Urubitinga anthracina.
529. Onychotes gruberi.[1]	000. [Properly removed from the List.]
531. Thrasyaëtus harpyia.	[350.] Thrasaëtus harpyia.
532. Aquila chrysaëtus.	349. Aquila chrysaëtos.
533. Haliaëtus albicilla.	[351.] Haliæëtus albicilla.
534. leucocephalus.	352. leucocephalus.
530. Pandion haliaëtus.	364. Pandion haliaëtus carolinensis.
536. Pseudogryphus californianus.	324. Pseudogryphus californianus.
537. Cathartes aura.	325. Cathartes aura.
538. Catharista atrata.	326. Catharista atrata.
539. Columba fasciata.	312. Columba fasciata.
540. erythrina.	313. flavirostris.
541. leucocephala.	314. leucocephala.
543. Ectopistes migratorius.	315. Ectopistes migratorius.
542. Engyptila albifrons.	318. Engyptila albifrons.
544. Zenaidura carolinensis.	316. Zenaidura macroura.
545. Zenaida amabilis.	317. Zenaida zenaida.
546. Melopelia leucoptera.	319. Melopelia leucoptera.
547. Chamæpelia passerina.	320. Columbigallina passerina.
548. passerina pallescens?	000. [Properly omitted from the List.].
549. Scardafella inca.	321. Scardafella inca.
550. Geotrygon martinica.	[322.] Geotrygon martinica.
551. Starnœnas cyanocephala.	[323.] Starnœnas cyanocephala.
552. Ortalis vetula maccalli.	311. Ortalis vetula maccalli.
553. Meleagris gallipavo.	310*a*. Meleagris gallopavo mexicana.[2]
554. gallipavo americana.	310. gallopavo.
555. Canace canadensis.	298. Dendragapus canadensis.
556. canadensis franklini.	299. franklinii.
557. obscura.	297. obscurus.
558. obscura richardsoni.	297*b*. obscurus richardsonii.
559. obscura fuliginosa.	297*a*. obscurus fuliginosus.
560. Centrocercus urophasianus.	309. Centrocercus urophasianus.
561. Pediœcetes phasianellus.	308. Pediocætes phasianellus.

[1] This bird, long a puzzle to ornithologists, has proved to be the *Buteo solitarius* of Peale. It is not a North American species, but was originally described from the Sandwich Islands, and afterward described and figured by Cassin as *Pandion solitarius*. See Pr. U. S. Nat. Mus., 1885, p. 36.

[2] The A. O. U. Committee has reversed the proper names of the wild turkeys, reverting to an old error long since exposed. See Key, p. 576.

COUES KEY, 1884.	UNION LIST, 1886.
562 Pediœcetes phasianellus columbianus.	308*a*. Pediocætes phasianellus columbianus
000. [Not admitted in the Key.]	308*b*. phasianellus campestris.
563. Cupidonia cupido.	305. Tympanuchus americanus.
	306. cupido.

563 *bis*. *Add:* **Cupidonia cupido brewsteri**. N. BREWSTER'S HEATH HEN. This is the variety of the prairie-hen peculiar to Martha's Vineyard, Mass., differing appreciably from the common stock, as pointed out by Mr. Brewster (Auk, 1885, p. 82), whose inconclusive argument that Linnæus based his name *Tetrao cupido* exclusively upon this form, leaves me the pleasure of dedicating the variety to the accomplished ornithologist who first called attention to its characters.

564. Cupidonia cupido pallidicinctus.	307. Tympanuchus pallidicinctus.
565. Bonasa umbella.	300. Bonasa umbellus.
000. [Not admitted in the Key.]	300*a*. umbellus togata.
566. Bonasa umbella umbelloides.	300*b*. umbellus umbelloides.
567. umbella sabinii.	300*c*. umbellus sabini.
568. Lagopus albus.	301. Lagopus lagopus.
000. [Not admitted in the Key.]	301*a*. lagopus alleni.[1]
569. Lagopus rupestris.	302. rupestris.
000. [Not admitted in the Key.]	302*a*. rupestris reinhardti.
000. [Not admitted in the Key.]	302*b*. rupestris nelsoni.
000. [Not admitted in the Key.]	302*c*. rupestris atkensis.
000. [Not admitted in the Key.]	303. welchi.
570. Lagopus leucurus.	304. leucurus.
571. Ortyx virginiana.	289. Colinus virginianus.
572. virginiana floridana.	289*a*. virginianus floridanus.
573. virginiana texana.	289*b*. virginianus texanus.
000. [Not admitted in the Key.]	290. graysoni [a mistake].
	291. ridgwayi.

573 *bis*. *Add:* **Ortyx ridgwayi**. ARIZONA BOB-WHITE. MASKED BOB-WHITE, HOODED QUAIL. Adult ♂: Front, and sides of head and neck, black, with or without a narrow white frontal line and superciliary stripe. Under parts chestnut or cinnamon (about the color of the breast of a robin), varying much in shade, generally unspotted, except on the flanks, where the feathers are usually tipped with an oval white spot, preceded by a subterminal black bar; lower tail-coverts with a V-shaped black spot bordered with whitish; occasionally small touches of black and white along the sides. Crown, hind head, and nape mixed black, white, and pale brown, or yellowish-white; hind neck and interscapulars reddish-brown, usually with a grayish cast; back, rump, and upper tail-coverts minutely variegated with blackish, pale brown, and grayish-white, the black usually prevailing, but variable in amount. Wing-coverts rufous, each feather barred with blackish and edged and tipped with whitish; primaries dusky, edged and scalloped internally with whitish; secondaries externally dusky, barred and freckled with pale brown and yellowish-white; inner secondaries and scapulars edged with yellowish-white (very broadly so on the inner edges), and otherwise variegated. Tail above bluish-gray, minutely freckled and waved with whitish; tail below gray, faintly and irregularly barred and waved with grayish-white. Bill black; feet horn-color; iris brown. Length 9.75; extent 14.25; wing 4.50; tail 2.75; tarsus 1.20. The female resembles that

[1] It is not easy to account for the perversity of the Committee in insisting upon recognizing by name among the ptarmigan characters which have repeatedly been shown to be elusive. Parallel perversity extended to birds at large would be ornithological anarchy. See Key, p. 568.

sex of *C. virginianus texensis* so closely as not to be distinguished with certainty. The species is closely related to *C. graysoni* of Mexico, and may be found in fact to intergrade with the latter. It inhabits southern Arizona and adjoining portions of Mexico, where it has long been known to the natives, though only recently recognized by ornithologists. From the first accounts which reached us, the bird was supposed to be *C. graysoni*, and it was entered under this name in the A. O. U. List. It was first named *C. ridgwayi* by *Brewster*, The Auk, April, 1885, p. 199. A monograph of the species and its allies, illustrated by a colored plate, is given by *Allen*, Bull. Amer. Mus. Nat. Hist., July, 1886, pp. 273–290, pl. 23.

COUES KEY, 1884.	UNION LIST, 1886.
574. Orortyx picta.	292. Oreortyx pictus.
000. [Not admitted in the Key.]	292*a*. pictus plumiferus.
575. Lophortyx californica.	294. Callipepla californica.
000. [Not admitted in the Key.]	294*a*. californica vallicola.
576. Lophortyx gambeli.	295. gambeli.
577. Callipepla squamata.	293. squamata.
	293*a*. squamata castanogastris.

577 *bis*. *Add:* **Callipepla squamata castaneiventris.** Chestnut-bellied Scaled Partridge. Like the last, but the general coloring deeper and richer; crown concolorous with the back, and cheeks with the breast, both much darker than the throat; and belly with a conspicuous central patch of uniform chestnut. The ♀ lacks this patch, and is much paler than the ♂. While the true *C. squamata* inhabits the Mexican table lands and thence into Arizona, New Mexico, and western Texas, this form appears to characterize the lower lands, extending into the lower Rio Grande valley. Bull. Nuttall Club, viii., Jan. 1883, p. 34.

578. Cyrtonyx massena.	296. Cyrtonyx montezumæ.
579. Coturnix dactylisonans.	000. [Not admitted in the List.]
580. Squatarola helvetica.	270. Charadrius squatarola.
581. Charadrius dominicus.	272. dominicus.
582. dominicus fulvus.	272*a*. dominicus fulvus.
583. pluvialis.	[271.] apricarius.
584. Ægialites vociferus.	273. Ægialitis vocifera.
585. wilsonius.	280. wilsonia.
586. semipalmatus.	274. semipalmata.
587. melodus.	277. meloda.
588. melodus circumcinctus?	277*a*. meloda circumcincta.
589. hiaticula.	275. hiaticula.
590. curonicus.	[276.] dubia.
591. cantianus nivosus.	278. nivosa.[1]
	[279.] mongola.

591 *bis*. *Add:* **Ægialites mongolicus.** Mongolian Plover. Adult ♂ ♀, in summer: Above, brownish-gray; below, white, with a broad cinnamon or chestnut pectoral bar, extending more or less along the sides, encircling the neck behind, and somewhat tinging the pileum. A long black subocular stripe, involving the lores and auriculars, reaching to the bill, continuous in front of the eye with a black frontlet, in advance of which is a white area divided by a narrow median line of black which connects the black frontlet with

[1] A proper change, giving this species full rank, as distinguished from *Æ. cantianus*, as suggested in the Key, p. 604.

the base of the culmen. Wing-feathers dusky; shaft of first primary white; several inner primaries with white area along their outer webs; the secondaries and greater coverts tipped with white. Tail-feathers like the back, tipped with white, and successively paler laterally, till the outermost are nearly white; upper tail-coverts also tipped with whitish. Bill and feet black. The young lack the distinctive chestnut and black markings, though the breast may be somewhat suffused with pale cinnamon, and at an early age all the feathers of the upper parts have pale edgings. Wing 5.25; tail 2.25; bill 0.70; tarsus 1.15; middle toe 0.75. A well-known species of wide distribution in the Old World, recorded from Choris Peninsula, Alaska. (See Ibis, 1870, p. 384; P. Z. S. 1871, pp. 111, 114.) It is entirely different from any other plover described in this work, and should long ago have been taken into the Key.

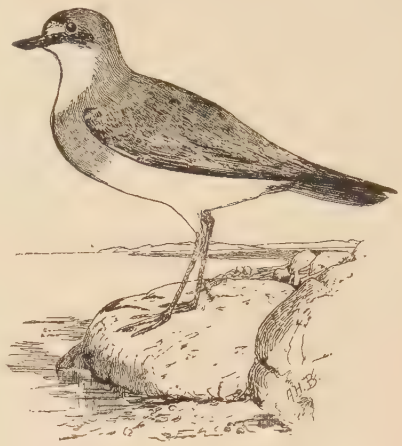

FIG. 562. — Mongolian Plover.

COUES KEY, 1884.	UNION LIST, 1886.
592. Podasocys montanus.	281. Ægialitis montana.
593. Vanellus cristatus.	[269.] Vanellus vanellus.
594. Aphriza virgata.	282. Aphriza virgata.
595. Hæmatopus ostrilegus.	[285.] Hæmatopus ostralegus.
596. palliatus.	286. palliatus.
597. niger.	287. bachmani.
598. Strepsilas interpres.	283. Arenaria interpres.
599. melanocephalus.	284. melanocephala.
600. Recurvirostra americana.	225. Recurvirostra americana.
601. Himantopus mexicanus.	226. Himantopus mexicanus.
602. Steganopus wilsoni.	224. Phalaropus tricolor.
603. Lobipes hyperboreus.	223. " lobatus.
604. Phalaropus fulicarius.	222. Crymophilus fulicarius.
605. Philohela minor.	228. Philohela minor.
606. Scolopax rusticula.	[227.] Scolopax rusticola.
607. Gallinago media.	[229.] Gallinago gallinago.
608. wilsoni.	230. delicata.
509. Macrorhamphus griseus.	231. Macrorhamphus griseus.
610. scolopaceus.	232. scolopaceus.
611. Micropalama himantopus.	233. Micropalama himantopus.
612. Ereunetes pusillus.	246. Ereunetes pusillus.
613. pusillus occidentalis.	247. occidentalis.
614. Actodromas minutilla.	242. Tringa minutilla.
	000. [Not admitted in the List.]

614 *bis*. *Add:* **Tringa damascensis**. DAMASCENE SANDPIPER. LONG-TOED STINT. Resembling the last in coloration. Shaft of first primary only, white. Middle toe and claw longer than tarsus or culmen; tips of outstretched toes reaching far beyond end of tail, and tip of tail beyond points of the folded wings; four outer pairs of tail-feathers of equal

lengths. Length 150 mm.; wing 88 mm.; tail 40 mm.; culmen 18 mm.; middle toe and claw 24 mm. This species has been taken on Otter Island, in Bering's Sea. Bull. U. S. Nat. Mus. No. 29, 1885, p. 116.

COUES KEY, 1884.	UNION LIST, 1886.
615. Actodromas bairdi.	241. Tringa bairdii.
616. maculata.	239. maculata.
617. bonapartii.	240. fuscicollis.
618. cooperi?	†11. cooperi.
619. acuminata.	238. acuminata.
620. Arquatella maritima.	235. maritima.
621. couesi.	236. couesi.
622. ptilocnemis.	237. ptilocnemis.
623. Pelidna alpina.	[243.] alpina.
624. alpina americana.	243*a*. alpina pacifica.
625. Ancylochilus subarquatus.	244. ferruginea.
626. Tringa canutus.	234. canutus.
627. Calidris arenaria.	248. Calidris arenaria.
884. Eurynorhynchus pygmæus.	[245.] Eurynorhynchus pygmæus.
628. Limosa fœda.	[249.] Limosa fedoa.
629. hæmastica.	251. hæmastica.
630. ægocephala.	[252.] limosa.
631. uropygialis.	250. lapponica baueri.
632. Symphemia semipalmata.	258. Symphemia semipalmata.
	000. [Not admitted in the List.]

632 *bis*. *Add:* **Symphemia semipalmata inornata**. Western Willet. Larger than the last, with longer and slenderer bill, fewer, finer, and fainter markings on the paler ground of the upper parts, and duller and more confused or broken markings on the under parts, these bordered with a pinkish-salmon color, which often suffuses most of the under parts; middle tail-feathers unmarked or only faintly barred. Wing 8.00; tail 3.30; tarsus 2.60; bill 2.25–2.70. Interior of North America, from the Mississippi to the Rocky Mountains, wintering on the South Atlantic and Gulf Coasts. The Auk, April, 1887, p. 145.

633. Totanus melanoleucus.	254. Totanus melanoleucus.
634. flavipes.	255. flavipes.
635. glottis.	[253.] nebularius.
636. Rhyacophilus ochropus.	[257.] ochropus.
637. solitarius.	256. solitarius.
638. Tringoides macularius.	263. Actitis macularia.
639. Machetes pugnax.	[260.] Pavoncella pugnax.
640. Bartramia longicauda.	261. Bartramia longicauda.
641. Tryngites rufescens.	262. Tryngites subruficollis.
642. Heteroscelus incanus.	259. Heteractitis[1] incanus.
643. Numenius longirostris.	264. Numenius longirostris.
644. phæopus.	[267.] phæopus.
645. hudsonicus.	265. hudsonicus.
646. borealis.	266. borealis.
647. taïtensis.	[268.] tahitiensis.
649. Plegadis falcinellus.	186. Plegadis autumnalis.

[1] This genus will stand, because *Heteroscelus* is preoccupied in entomology.

COUES KEY, 1884.	UNION LIST, 1886.
650. Plegadis guarauna.	187. Plegadis guarauna.
651. Eudocimus albus.	184. Guara alba.
652. ruber.	[185.] rubra.
653. Ajaja rosea.	183. Ajaja ajaja.
648. Tantalops loculator.	188. Tantalus loculator.
654. Mycteria americana.	[189.] Mycteria americana.
655. Ardea herodias.	194. Ardea herodias.
656. occidentalis.	192. occidentalis.
000. wardi.	193. wardi.
657. cinerea.	[195.] cinerea.
658. Herodias egretta.	196. egretta.
659. Garzetta candidissima.	197. candidissima.
660. Hydranassa tricolor.	199. tricolor ruficollis.
661. Dichromanassa rufa.	198. rufa.
662. Florida cœrulea.	200. cœrulea.
663. Butorides rufescens.	201. Ardea virescens.
664. Nyctiardea grisea nævia.	202. Nycticorax nycticorax nævius.
665. Nycterodius violaceus.	203. violaceus.
666. Botaurus mugitans.	190. Botaurus lentiginosus.
667. Ardetta exilis.	191. exilis.
	000. [Not admitted in the List.]

667 *bis*. *Add:* **Ardetta neoxena**. Florida Dwarf Bittern. Crown, back and tail black, glossed with green. Sides of head and throat chestnut, the feathers on the back of the neck tipped with greenish-black. Breast and under parts rufous chestnut, nearly uniform, shading into blackish on the sides; under tail-coverts dull black; upper wing-coverts rufous chestnut, the under ones paler chestnut; all the remiges slaty plumbeous. Length 10.80; wing 4.30; tarsus 1.40; bill 1.80. Southwestern Florida. The Auk, April, 1886, p. 262.

668. Grus americana.	204. Grus americana.
669. canadensis.	205. canadensis.
670. pratensis.	206. mexicana.
671. Aramus pictus.	207. Aramus giganteus.
672. Parra gymnostoma.	[288.] Jacana gymnostoma.
673. Rallus longirostris crepitans.	211. Rallus longirostris crepitans.
674. longirostris obsoletus.	210. obsoletus.
675. longirostris saturatus.	211*a*. longirostris saturatus.
676. elegans.	208. elegans.
	209. beldingi.

676 *bis*. *Add:* **Rallus beldingi**. Belding's Rail. Most like *R. elegans*, but darker and richer colored throughout, the white bars of the flanks much narrower, the blackish bars very distinct. Wing 5.70; tail 2.50; bill 2.15; tarsus 1.90. A species which takes its place in the Key under our ruling to admit the islands pertaining to Lower California. Espiritu Santo Island, Gulf of California. Pr. U. S. Nat. Mus., v. 1882, p. 345.

677. Rallus virginianus.	212. Rallus virginianus.
678. Porzana maruetta.	[213.] Porzana porzana.
679. carolina.	214. carolina
680. noveboracensis.	215. noveboracensis.
681. jamaicensis.	216. jamaicensis.

COUES KEY, 1884.	UNION LIST, 1886.
682. Porzana jamaicensis coturniculus.	216*a*. Porzana jamaicensis coturniculus.
683. Crex pratensis.	[217.] Crex crex.
684. Gallinula galeata.	219. Gallinula galeata.
685. Ionornis martinica.	218. Ionornis martinica.
686. Fulica americana.	221. Fulica americana.
885. atra.	[220.] atra.
687. Phœnicopterus ruber.	182. Phœnicopterus ruber.
688. Cygnus buccinator.	181. Olor buccinator.
689. columbianus.	180. columbianus.
690. musicus.	[179.] cygnus.
691. [See Key, p. 683.]	
692. Anser albifrons.	[171.] Anser albifrons.
693. albifrons gambeli.	171*a*. albifrons gambeli.
694. Chen cœrulescens.	†8. Chen cœrulescens.
695. hyperboreus.	169*a*. hyperborea nivalis.
696. hyperboreus albatus.	169. hyperborea.
697. rossi.	170. rossii.
698 Philacte canagica.	176. Philacte canagica.
699. Bernicla leucopsis.	[175.] Branta leucopsis.
700. branta.	173. bernicla.
701. branta nigricans.	174. nigricans.
702. canadensis.	172. canadensis.
702*a*. canadensis occidentalis.	172*b*. canadensis occidentalis.
703. canadensis leucoparia.	172*c*. canadensis minima.
704. canadensis hutchinsi.	172*a*. canadensis hutchinsii.
705. Dendrocygna fulva.	178. Dendrocygna fulva.
706. autumnalis.	177. autumnalis.
707. Anas boscas.	132. Anas boschas.
708. obscura.	133. obscura.
709. obscura fulvigula.	134. fulvigula.
710. Dafila acuta.	143. Dafila acuta.
711. Chaulelasmus streperus.	135. Anas strepera.
712. Mareca penelope.	136. penelope.
713. americana.	137. americana.
714. Querquedula crecca.	[138.] crecca.
715. carolinensis.	139. carolinensis.
716. discors.	140. discors.
717. cyanoptera.	141. cyanoptera.
718. Spatula clypeata.	142. Spatula clypeata.
719. Aix sponsa.	144. Aix sponsa.
886. Fuligula rufina.	[145.] Netta rufina.
720. marila.	148. Aythya[1] marila nearctica.[2]
721. affinis.	149. affinis.
722. collaris.	150. collaris.
723. ferina americana.	146. americana.
724. vallisneria.	147. vallisneria.
725. Clangula glaucium.	151. Glaucionetta clangula americana.

[1] The proper spelling of this word is Æthyia.

[2] The alleged subspecies *nearctica* cannot be recognized without further evidence.

COUES KEY, 1884.	UNION LIST, 1886.
726. Clangula islandica.	152. Glaucionetta islandica.
727. albeola.	153. Charitonetta albeola.
728. Harelda glacialis.	154. Clangula hyemalis.
729. Camptolæmus labradorius.	156. Camptolaimus labradorius.
730. Histrionicus minutus.	155. Histrionicus histrionicus.
731. Somateria stelleri.	157. Eniconetta stelleri.
732. fischeri.	158. Arctonetta fischeri.
733. mollissima.	159. Somateria mollissima.
734. mollissima dresseri.	160. dresseri.
735. v-nigrum.	161. v-nigra.
736. spectabilis.	162. spectabilis.
737. Œdemia americana.	163. Oidemia americana.
	[164.] fusca.

737 *bis*. *Add:* **Œdemia fusca.** European Scoter. The true scoter of Europe and Asia (of which our velvet scoter may be a recognizable variety, as long ago pointed out by Cassin and Bonaparte) has occurred in Greenland and Alaska as a straggler from the Old World, and may therefore take place in our list. It is distinguished from the American *O. f. velvetina* by a somewhat different outline of the feathers upon the base of the upper mandible, leaving the length of the culmen greater than the lateral length of the bill from the loral feathers along the side to the tip; and by a black stripe in the red of the bill.

738. Œdemia fusca velvetina.	165. Oidemia deglandi.
739. perspicillata.	166. perspicillata.
740. perspicillata trowbridgii?	000. [Not admitted in the List.]
741. Erismatura rubida.	167. Erismatura rubida.
742. Nomonyx dominica.	[168.] Nomonyx dominica.
743. Mergus merganser.[1]	129. Merganser americanus.
744. serrator.	130. serrator.
745. cucullatus.	131. Lophodytes cucullatus.
746. Sula bassana.	117. Sula bassana.
747. leucogastra.	115. sula.
	114. cyanops.

747 *bis*. *Add:* **Sula cyanops.** Blue-faced Booby. Adult ♂ ♀: White; greater wing-coverts, bastard quills, primaries and their coverts, dusky brown; tail-feathers the same, the middle pair mostly whitish and the others whitish at the bases; face and gular sac blue, drying blackish; feet light red. Young: Head, neck, and upper parts dark grayish-brown; lower parts from the neck white; middle of back and upper part of rump streaked with white, flanks with gray. Wing 14.50; tail 7.75; bill along culmen 3.50, its depth at base 1.25; tarsus 1.75; middle toe 2.25. A species of wide distribution in warm seas, inhabiting the West Indies and occasionally occurring in southern Florida. It should have been admitted to the second edition of the Key.

116. Sula piscator.

747 *ter*. *Add:* **Sula piscator.** Red-footed Booby. Adult ♂ ♀: White; head and neck tinged with buff; wing-feathers, primary coverts, and greater secondary coverts slate-gray; shafts of tail-feathers pale yellow. Feet coral-red; iris brown; gular sac black; bare space

[1] As pointed out by Mr. Cassin in 1853, the American sheldrake may be recognized, in comparison with the European, by the black bar which partly divides the white area on the wing, and some average difference in the bill, which is shorter than that of the true *M. merganser*. (Pr. Phila. Acad. 1853. p. 187.)

around eye violet-blue; base of bill purplish-red. Young: more or less dusky and gray. The coloration is extremely variable, but the species is not to be confounded with any of the others here given. Length 29.00; extent 60.00; wing 15.00; tail 9.00; bill along culmen 3.25, its depth at base 1.10 or less; tarsus 1.35; middle toe 2.25. A species like the last in its distribution, supposed to occur also in Florida.

COUES KEY, 1884.	UNION LIST, 1886.
748. Pelecanus trachyrhynchus.	125. Pelecanus erythrorhynchos.
749. fuscus.	126. fuscus.
	127. californicus.

749 *bis*. *Add:* **Pelecanus fuscus californicus**. Californian Brown Pelican. Similar to the last; larger; bill 12.00 to nearly 15.00; wing 20.00–23.00. In full breeding plumage the pouch mostly reddish, the bare skin around eye brown, and the back of the neck brownish-black instead of chestnut. Coast of California. Water Birds N. A., ii. p. 143.

750. Phalacrocorax carbo.	119. Phalacrocorax carbo.
751. dilophus.	120. dilophus.
752. dilophus cincinnatus.	120*b*. dilophus cincinnatus.
753. dilophus floridanus.	120*a*. dilophus floridanus.
753*a*. dilophus albociliatus.	120*c*. dilophus albociliatus.
754. mexicanus.	121. mexicanus.
755. penicillatus.	122. penicillatus.
756. perspicillatus.	†7. perspicillatus.
757. bicristatus.	124. urile.
000. [Not admitted in the Key.]	123. pelagicus.
758. Phalacrocorax violaceus.	123*a*. pelagicus robustus.
759. violaceus bairdi.	123*b*. pelagicus resplendens.
760. Plotus anhinga.	118. Anhinga anhinga.
761. Tachypetes aquilus.	129. Fregata aquila.
762. Phaëthon æthereus.	113. Phaëthon æthereus.
763. flavirostris.	114. flavirostris.
764. Stercorarius skua.	35. Megalestris skua.
765. pomatorhinus.	36. Stercorarius pomarinus.
766. parasiticus.	37. parasiticus.
767. buffoni.	38. longicaudus.
768. Larus glaucus.	42. Larus glaucus.
769. leucopterus.	43. leucopterus.
770. glaucescens.	44. glaucescens.
770*a*. kumlieni.	45. kumlieni.
	46. nelsoni.

770 *bis*. *Add:* **Larus nelsoni**. Nelson's Gull. Bill robust, relatively short; tarsus a little shorter (?) than middle toe and claw. Head, neck, tail, and entire under parts pure white; mantle pale pearl-blue, lighter than in *glaucescens*, about as in *leucopterus* and *kumlieni*. "A close ally of *L. kumlieni*, which bird, indeed, it may represent upon the N. W. Pacific coast. The main point of distinction is size, *nelsoni* being considerably larger." Wing 17.25; tail 8.90; culmen 2.20; bill along gape 3.00, depth 0.86, tarsus 3.00; middle toe and claw 2.90. A very dubious gull, improbably a distinct species. The Auk, July, 1884, p. 250.

771. Larus marinus.	47. Larus marinus.
	48. schistisagus.

COUES KEY, 1884.	UNION LIST, 1886.

771 *bis*. *Add:* **Larus marinus schistisagus**. SLATY-BACKED GULL. Adult: white; mantle dark slate-gray. First primary with a long white tip and a gray wedge on the inner web: second with a subapical white spot on the inner web only, and the gray wedge further down: third with the gray wedge reaching the subapical spot: no gray wedge on outer webs of first four primaries. Feet pinkish flesh-color. Bill yellow, with red spot on gonys. Iris yellowish cream-color. Nearly the size of the last, from which probably not distinct. N. Pacific and Arctic Oceans, coast of Alaska. Bull. U. S. Nat. Mus., No. 29, 1885, p. 67.

772. Larus argentatus.	51. Larus argentatus.
773. argentatus smithsonianus.	51*a*. argentatus smithsonianu
774. occidentalis.	49. occidentalis.
775. cachinnans.	52. cachinnans.
776. affinis.	[50.] affinis.
777. californicus.	53. californicus.
778. delawarensis.	54. delawarensis.
779. canus.	[56.] canus.
780. brachyrhynchus	55. brachyrhynchus.
781. heermanni.	57. heermanni.
782. Rissa tridactyla.	40. Rissa tridactyla.
783. tridactyla kotzebuii.	40*a*. tridactyla pollicaris.
784. brevirostris.	41. brevirostis.
785. Pagophila eburnea.	39. Gavia alba.
786. Chroicocephalus atricilla.	58. Larus atricilla.
787. franklini.	59. franklini.
788. philadelphia.	60. philadelphia.
789. Rhodostethia rosea.	61. Rhodostethia rosea.
790. Xema sabinii.	62. Xema sabinii.
791. furcata.	†4. furcata.
792. Sterna anglica.	63. Gelochelidon nilotica.
793. caspia.	64. Sterna tschegrava.
794. maxima.	65. maxima.
795. elegans.	66. elegans.
796. cantiaca.	67. sandvicensis acuflavida.
797. hirundo.	70. hirundo.
798. forsteri.	69. forsteri.
799. macrura.	71. paradisæa.
800. dougalli.	72. dougalli.
801. superciliaris antillarum.	74. antillarum.
802. trudeaui.	[68.] trudeaui.
803. aleutica	73. aleutica.
804. fuliginosa.	75. fuliginosa.
805. anæsthetica.	[76.] anæthetus.
806. Hydrochelidon lariformis.	77. Hydrochelidon nigra surinamensis.
807. leucoptera.	[78.] leucoptera.
808. Anous stolidus.	79. Anous stolidus.
809. Rhynchops nigra.	80. Rynchops nigra.
	00. [Not admitted in the List.]

809 *bis*. *Add:* **Diomedea exulans**. WANDERING ALBATROSS. Adult: White, more or less tinged with yellowish, the flight-feathers dusky, the larger wing-coverts and the back usually barred with blackish. Bill very stout, with deeply concave culmen, and angulated

outline of feathers on both mandibles; whitish, with a pink or yellow tinge. Very large: length, 4.00–4.50 feet; extent 10 feet or more, usually about 10 50. Young are dark colored, whitening on the head. It is probable that this species, already several times included in our Fauna, and then dropped for lack of sufficient evidence of its occurrence, requires to be reinstated. Its appearence in Florida has lately been recorded. The Auk, Oct. 1885, p. 387.

COUES KEY, 1884.	UNION LIST, 1886.
810. Diomedea brachyura.	82. Diomedea albatrus.
811. nigripes.	81. nigripes.
	83. Thalassogeron culminatus.

811 *bis*. *Add:* **Diomedea culminata**. CULMINATING ALBATROSS. Adult: Above, grayish-brown, lightening to ashy-gray on the neck and head, whitening on the under parts, darkening on the wings to the dusky brown of the flight-feathers; lower eyelid, rump, and upper tail-coverts white; tail slate-gray; shafts of primaries and tail-feathers yellowish. Bill blackish, the culmen and most of the side of the lower mandible more or less yellow. Wing 21.00; bill along culmen 4.50, its depth at base 1.75; tarsus 3.25. A handsome albatross of medium size, inhabiting southern seas, said by Audubon to have occurred off the Columbia River. Audubon described it as the yellow-nosed albatross, *D. chlororhyncha;* but his specimen, which I handled many years ago, is clearly of this species, as I first pointed out in Pr. Phila. Acad., 1866, p. 183.

812. Phœbetria fuliginosa.	84. Phœbetria fuliginosa.
813. Ossifraga gigantea.	[85.] Ossifraga gigantea.
814. Fulmarus glacialis.	86. Fulmarus glacialis.
	86*a*. glacialis minor.

814 *bis*. *Add:* **Fulmarus glacialis minor**. LESSER ATLANTIC FULMAR. Like the last: smaller; wing only 12.00; bill 1.35; tarsus about 1.75; middle toe 2.15.

815. Fulmarus glacialis pacificus.	86*b*. Fulmarus glacialis glupischa.
816. glacialis rodgersi.	86*c*. glacialis rodgersi.
817. Priocella tenuirostris.	87. glacialoides.
818. Daptium capense.	[102.] Daption capensis.
819. Œstrelata hæsitata.	[98.] Æstrelata hasitata.
887. gularis.	[99.] gularis.
887*a*. fisheri.	100. fisheri.
820. bulweri.	[101.] Bulweria bulweri.
821. Halocyptena microsoma.	103. Halocyptena microsoma.
822. Procellaria pelagica.	104. Procellaria pelagica.
823. Cymochorea leucorrhoa.	106. Oceanodroma leucorhoa.
824. melæna.	107. melania
825. homochroa.	108. homochroa.
826. Oceanodroma furcata.	105. furcata.
827. hornbyi.	†6. hornbyi.
828. Oceanites oceanicus.	109. Oceanites oceanicus.
829. Fregetta grallaria.	[110.] Cymodroma grallaria.
	[111.] Pelagodroma marina.

829 *bis*. *Add:* **Pelagodroma marina**. WHITE-FACED PETREL. Bill remarkably long, slender, and compressed, the short nasal tubes less than half as long as the culmen, the hook at the end weak. Wings of moderate length, reaching when folded just beyond the end of the tail. Tail long, square, or but slightly emarginate, the feathers broad, with truncate ends. Legs very long; tibiæ bare an inch or more; middle toe and claw nearly as long as

the tarsus; webs very full. Color ashy-gray, deepening into blackish on the wings and tail; the under parts, forehead, and line over the eye, white. Webs yellow. A large and handsome stormy petrel, related to *F[illegible]* (or *O[illegible]*), but readily distinguished, generically as well as specifically. It inhabits southern seas, and has been once taken off the coast of Massachusetts, lat. 40° 34′ 18″ N., long. 66° 09′ W. The Auk, Oct. 1885, p. 386.

COUES KEY, 1884.	UNION LIST, 1886.
830. Priofinus melanurus.	[97.] Puffinus cinereus.
831. Puffinus kuhli.	†5. kuhlii.
888. borealis.	88. borealis.
832. major.	89. major.
833. creatopus.	91. creatopus.
834. anglorum.	[90.] puffinus.
835. obscurus.	92. auduboni.
836. opisthomelas.	93. gavia.
837. fuliginosus.	94. stricklandi.
838. amaurosoma.	95. griseus.
839. tenuirostris.	96. tenuirostris.
840. Colymbus torquatus.	7. Urinator imber.
841. torquatus adamsi.	8. adamsii.
842. arcticus.	9. arcticus.
843. arcticus pacificus.	10. pacificus.
844. septentrionalis.	11. lumme.
845. Æchmophorus occidentalis.	1. Æchmophorus occidentalis.
846. occidentalis clarki.	†1. clarkii.
847. Podicipes griseigena holbœlli.	2. Colymbus holbœllii.
848. cornutus.	3. auritus.
849. auritus.	0. [Not admitted in the List.]
850. auritus californicus.	4. Colymbus nigricollis californicus.
851. dominicus.	5. dominicus
852. Podilymbus podicipes.	6. Podilymbus podiceps.
853. Fratercula corniculata.	14. Fratercula corniculata.
854. arctica.	13. arctica
855. arctica glacialis.	13*a*. arctica glacialis.
856. Lunda cirrata.	12. Lunda cirrhata.
857. Ceratorhina monocerata.	15. Cerorhinca monocerata.
858. Simorhynchus psittaculus.	17. Cyclorrhynchus psittaculus.
859. cristatellus.	18. Simorhynchus cristatellus.
860. pygmæus.	19. pygmæus.
861. pusillus.	20. pusillus.
862. Ptychorhamphus aleuticus.	16. Ptychoramphus aleuticus.
863. Alle nigricans.	34. Alle alle.
864. Synthliborhamphus antiquus.	21. Synthliboramphus antiquus.
865. umizusume.	22. wumizusume.
866. Brachyrhamphus marmoratus.	23. Brachyramphus marmoratus.
867. kittlitzi.	24. kittlitzii.
868. hypoleucus.	25. hypoleucus.
869. craverii ?	26. craveri.
870. brachypterus ?	00. [Not admitted in the List.]
871. Uria grylle.	27. Cepphus grylle.
	28. mandtii.

COUES KEY, 1884.	UNION LIST, 1886.

871 *bis*. *Add:* **Uria grylle mandti**. MANDT'S GUILLEMOT. Similar to the last, and probably only the perfected plumage of it, having the white on both sides of the wing pure and unbroken; the bill said to be smaller. A circumpolar range is ascribed to this form, which is said to come south in winter as far as New Jersey and Norton Sound, Alaska.

872. Uria columba.	29. Cepphus columba.
873. carbo.	†3. carbo.
	†2. motzfeldi.

873 *bis*. *Add:* **Uria carbo motzfeldi**. MOTZFELD'S GUILLEMOT. Like the last, but lacking the whitish patch on the side of the head. North Atlantic; Greenland.

874. Lomvia troile	30. Uria troile.
875. troile californica.	30*a*. troile californica.
876. arra.	31*a*. lomvia arra.
876 *bis*. [See Key, p. 818.]	31. lomvia.
877 Utamania torda.	32. Alca torda.
878. Alca impennis.	33. Plautus impennis.

SECOND APPENDIX.

SINCE the publication of the Third Edition of the KEY, in 1887, the American Ornithologists' Union has continued its active work upon North American Birds. A Committee of the Union published in 1889 a "Supplement to the Code of Nomenclature and Check-list of North American Birds adopted by the American Ornithologists' Union" (New York, pp. iv., 23). The same Committee published in January, 1890, a "Second Supplement" (The Auk, VII., No. 1, pp. 60–66). Each of these Supplements treats briefly of — I. Additions; II. Eliminations; III. Changes of Nomenclature; the Second Supplement also of — IV. Species and Subspecies considered as not entitled to recognition (being a few published in 1889 which the Committee disapprove).

Some of the changes made in these two Supplements of 1889 and 1890 support the stand taken by the KEY LIST of 1887 against the *Union List* of 1886; some are merely synonymatic; others are actual additions to our knowledge of North American Birds.

The foregoing "Appendix" (pp. 865–895 of the KEY), shows in double columns the differences between the KEY LIST of 1884, and the *Union List* of 1886, and introduces such changes as I saw fit to make in the third edition of 1887.

The present "Second Appendix" notes every further change reported by the Union's Committee from 1887 to January 1890 inclusive. In most cases I prefer to express no individual opinion, for the judgment of the Committee is presumed to be final so far as present evidence is concerned. But the names of species and subspecies which I am fully prepared to admit to the KEY as additions or emendations are printed in **thick type**.

E. C.

SMITHSONIAN INSTITUTION, WASHINGTON, D. C., April, 1890.

No. 13 *a*, p. 248. *Turdus sequoiensis*, Anthony, Proc. Cala. Acad. Sci., 2d ser., II., June, 1889, is deferred for final action by the Committee, owing to insufficient evidence.

No. 18, p. 251. *Harporhynchus rufus longirostris* becomes *H. longirostris sennetti*, Ridgway, Pr. U. S. Nat. Mus., Aug. 1888, p. 506.

No. 28, p. 258. The Committee decline to recognize *Sialia mexicana anabelæ* of Anthony, Proc. Cala. Acad. Sci., 2d ser., II., Oct. 1889, p. 79, deeming the ascribed characters insufficient.

No. 36 *a*, p. 261. *Polioptila cærulea obscura*, named by Ridgway in 1883 (Pr. U. S. Nat. Mus., V., p. 535), is now recognized by the Committee, and assigned a local habitation in California, Arizona, and western Mexico.

No. 40 *bis*, p. 866. *Lophophanes bicolor texensis*, which I recognized in 1887, is confirmed under the original name, *Parus bicolor texensis*.

No. 49 *a*, p. 267. *Parus hudsonicus stoneyi* is a new subspecies described from the Kowak River in Alaska as *P. stoneyi* by Ridgway,

Man. N. A. Birds, 1887, p. 591. It is said to be "similar to *P. hudsonicus*, but much grayer above, sides of neck purer ash-gray, sides much paler rusty, and throat clear slate-black instead of sooty blackish." As only three specimens were known, the characters adduced may not be confirmed when larger series from the same locality show how great may be the range of individual variation in shades of coloration.

No. 47 *a*, p. 266. *Parus carolinensis agilis* is a new subspecies described from eastern and central Texas by Sennett, Auk, Jan. 1888, p. 46.

No. 54 *a*, p. 268. *Psaltriparus santaritæ* is a new species from the Santa Rita Mountains of Arizona, described by Ridgway, Pr. U. S. Nat. Mus., Sept. 1888, p. 697.

No. 55, p. 268. *Psaltriparus melanotis* becomes **P. lloydi**, Sennett, Auk, Jan. 1888, p. 43.

No. 61 *a*, p. 271. *Sitta pygmæa leuconucha* is described from the San Pedro Mountains of Lower California by Anthony, Pr. Cala. Acad. Sci., 2d ser., II., Oct. 1889, p. 77, and recognized as a subspecies by the Committee.

No. 62 *b*, p. 273. *Certhia familiaris montana*, Ridgway, Pr. U. S. Nat. Mus., July, 1882, p. 114, is recognized as a valid subspecies, inhabiting the Rocky Mountains from northern Mexico to Alaska. It is said to differ from the common Creeper in being grayer above, with more distinctly contrasted tawny rump, and longer bill, wings, and tail.

No. 62 *c*, p. 273. *Certhia familiaris occidentalis*, Ridgway, Pr. U. S. Nat. Mus., July, 1882, p. 114, is recognized as a valid subspecies, inhabiting the Pacific Coast from California to southern Alaska. It is said to be darker and more rusty in general cast of plumage, with the lateral lower parts more or less strongly tinged with brownish, the supercilliary stripe browner, and the wing-markings buffy.

No. 67 *a*, p. 276. **Catherpes mexicanus punctulatus,** the Dotted Cañon Wren, which I admitted to the KEY in 1884, but which the Committee disallowed in the Union List of 1886, is recognized in the List of 1889.

No. 70 *a*, p. 277. *Thryothorus ludovicianus lomitæ* is described by Sennett, Auk, Jan. 1890, p. 58, from Lomita, southeastern Texas, and recognized by the Committee. It appears to be intermediate between *T. ludovicianus* and *T. l. berlandieri.*

No. 75 *bis*, p. 278. *Add:* **Troglodytes domesticus aztecus.** AZTEC HOUSE-WREN. (*T. aëdon aztecus*, Baird, Rev. Am. Birds, 1864, p. 139.) This is the form of Western House-Wren which has usually been called "Parkman's Wren." It occurs from Illinois westward and south into Mexico, but not on the Pacific coast of the United States, where it is replaced by *T. d. parkmani.* The description of the latter in the KEY includes *aztecus.* See Allen, Auk, April, 1888, p. 164.

No. 80, p. 279. This subspecies of Marsh Wren, admitted with a query in the KEY, is confirmed under its original name, *Cistothorus palustris paludicola* of Baird, Rev. Am. Birds, 1864, p. 148.

No. 80 *bis*, p. 279. *Add:* **Telmatodytes marianæ.** MARIAN'S MARSH WREN. Like *T. palustris;* coloration olivaceous instead of rufous brown; under parts darker; upper and under tail-coverts and flanks barred. A dark form, apparently resident. Tarpon Springs, southwestern Florida. *Cistothorus marianæ*, Scott, Auk, April, 1888, p. 188.

No. 111 *a*, p. 298. *Dendroica* [*lege Dendrœca*] *æstiva sonorana*, Brewster, Auk, April, 1888, p. 137, of western Texas, southern Arizona, and northwestern Mexico, is admitted by the Committee.

No. 141 *a*, p. 310. *Geothlypis trichas ignota* is described by Chapman, Auk, Jan. 1890, p. 11, from Florida and Georgia, as like *G. trichas*, but with longer tarsus, tail, and bill, shorter first primary, and deeper coloration. This local race is admitted by the Committee.

The *G. trichas roscoe* revived by Hasbrouck, Auk, April, 1889, p. 167, is rejected by the Committee, on the ground that "*Sylvia*" *roscoe* of Audubon is a mere synonym of *G. trichas*, and that what Mr. Hasbrouck called *G. t. roscoe* should be *G. t. ignota.*

No. 153, p. 317. *Certhiola bahamensis* be-

comes **Cœreba** *bahamensis*. See Ridgway, Man. N. A. Birds, 1887, p. 590.

No. 157 *bis*, p. 318. **Piranga rubriceps**. A South American Tanager which has accidentally occurred in Santa Barbara Co., California. See Bryant, Auk, Jan. 1887, p. 78. It was originally named by the late Mr. George Robert Gray, in Gray and Mitchell's Genera of Birds, Vol. II., 1844, and figured on plate 89 of that great work.

No. 165 *bis*, p. 325. *Progne cryptoleuca* of Baird, Rev. Am. Birds, May, 1865, which I have never admitted to the KEY, and which was not allowed in the Union List of 1886, is now recognized by the Committee as a good species. It may perhaps stand as a smaller race of the common house martin, to be known as *P. subis* **cryptoleuca.** The tail is said to be narrower, and relatively more deeply forked ; and the adult male to have the feathers of the ventral region marked beneath the surface with white, whence the name *cryptoleuca*. The size is less than that of *P. subis*. This race occurs in Florida, Cuba, and probably in Central America.

No. 165 *ter*, p. 325. *Progne subis hesperia*. This western Martin is described from California by Brewster, Auk, April, 1889, p. 92. The male is said to be indistinguishable from the ordinary *P. subis*, and the female to differ from that of *P. subis* in having the belly, vent, and crissum white, nearly or quite immaculate; the flanks, breast, throat, forehead, and nuchal collar grayish-white, the feathers of the back and rump edged with grayish or pale brown, the bend of the wings and under wing-coverts spotted with white.

No. 177 *bis*, p. 872. *Vireo solitarius alticola*, Brewster, Auk, Jan. 1886, p. 111, admitted to the KEY in 1887, is confirmed by the Committee.

No. 181 *bis*, p. 872. *Vireo noveboracensis maynardi*, Brewster, Auk, April, 1887, p. 148, admitted to the KEY in 1887, is confirmed by the Committee.

No. 188 *a*, p. 338. *Lanius ludovicianus gambeli*, Ridgway, Man. N. A. Birds, 1887, p. 467, is named as a new subspecies from the coast of California, and approved by the Committee. The author names and attempts to characterize it "with extreme reluctance," yet has felt "compelled to do so, or else drop *L. excubitoroides*."

No. 196, p. 347. *Carpodacus frontalis* is reduced to *C. mexicanus frontalis*, Ridgway, Man. N. A. Birds, p. 391.

No. 196, p. 347. A new subgenus *Burrica* is based on *Carpodacus mexicanus* (*Fringilla mexicana*, Müller, Syst. Nat. Suppl. 1766, p. 165) of Ridgway (Pr. Biol. Soc. Washington, 1885, p. 111), Man. N. A. Birds, 1887, p. 390.

No. 196 *a*, p. 347. *Carpodacus mexicanus ruberrimus* is doubtfully named by Ridgway, Man. N. A. Birds, 1887, p. 392, as the St. Lucas House Finch, a subspecies inhabiting Lower California and parts of Sonora.

No. 197, p. 348. *Carpodacus frontalis rhodocolpus*, which I reluctantly admitted as an "alleged variety," is properly eliminated by the Committee.

No. 219 *a*, p. 356. *Plectrophanes nivalis townsendi* is described from the Prybilof and Commander Islands by Ridgway, Man. N. A. Birds, 1887, p. 403, as a new subspecies of *Plectrophenax*, differing from *P. nivalis* in being larger, with a longer bill.

No. 233 *a*, p. 365. *Poocœtes* [*lege Poœcetes*] *gramineus affinis*, Miller, Auk, Oct. 1888, p. 404, is admitted from California and western Oregon, as the Oregon Vesper Sparrow. It is compared with the eastern form in the color of the upper parts, and with the western *confinis* in the slender bill and narrow dorsal streaks.

No. 239 *a*, p. 369. *Ammodramus maritimus peninsulæ*, Allen, Auk, July, 1888, p. 284, is a new subspecies of the Seaside Finch described from southwestern Florida and along the Gulf coast to Louisiana. It is compared with *A. nigrescens*.

No. 239 *b*, p. 368. *Ammodramus maritimus sennetti*, Allen, Auk, July, 1888, p. 286, is described as a new subspecies from Corpus Christi, coast of Texas. In this form, as in *A. m. peninsulæ*, the young birds appear to be more readily distinguishable from allied races than the adults are.

No. 240 *a*, p. 368. *Ammodramus caudacu-*

tus subvirgatus, the Acadian Sharp-tailed Sparrow, is described as a new subspecies by Dwight, Auk, July, 1887, p. 233, and the Committee give its range as the coast of southern New Brunswick, Prince Edward Island, probably Nova Scotia, and southward at least to Long Island. It is said to be "similar in size and coloring to *A. caudacutus*, but paler and much less conspicuously streaked beneath with pale greenish gray instead of black or deep brown. Bill averages smaller. Compared with *nelsoni* it is much paler and grayer, generally larger and with a longer bill."

No. 242 *bis*, p. 370. *Add: Melospiza lincolni* **striata.** FORBUSH'S SPARROW. Similar to *M. lincolni;* superciliary stripe and whole upper parts more strongly olivaceous, with the dark streaks coarser, blacker, and more numerous, especially on the pileum, back, and upper tail-coverts. British Columbia. Brewster, Auk, April, 1889, p. 89.

No. 247 *a*, p. 372. *Melospiza fasciata rivularis*, Bryant, Proc. Cala. Acad. Sci., Sept. 1888, p. 197, is a new subspecies of Song Sparrow described from Lower California, and recognized by the Committee.

No. 261 *a*, p. 874, note. *Junco hiemalis carolinensis*, Brewster, Auk, Jan. 1888, p. 108, is now recognized by the Committee as a valid species under the name *J. carolinensis*. It is that form of eastern Snowbird which breeds in the southern Alleghanies.

No. 267 *quater*, p. 379. *Junco hiemalis* **townsendi.** Anthony, Proc. Cala. Acad. Sci., 2d ser., Oct. 1889, p. 76, describes a new Snowbird from the San Pedro Mountains as *J. townsendi*, the full specific rank of which is allowed by the Committee in the Second Supplement, 1889.

No. 271 *bis*, p. 875. This subspecies, admitted to the KEY in 1887, is confirmed by the Committee, under the name *Spizella pusilla* **arenacea,** Western Field-Sparrow.

No. 291 *bis*, p. 390. *Add: Guiraca cærulea* **eurhyncha**, described by me in Amer. Nat., Sept. 1874, p. 573, but never taken into the KEY, through deference to the opinion of the Committee, is now recognized by them as a valid subspecies inhabiting Mexico, north to Colorado and California. It is somewhat larger than the common Blue Grosbeak, of a rather paler blue, and has a disproportionately larger bill, as implied in the name.

No. 293 *a*, p. 391. *Passerina versicolor pulchra*, the "Beautiful Bunting," is described as a new subspecies from Lower California and northwestern Mexico by Ridgway, Man. N. A. Birds, 1887, p. 448. The length assigned (5.50 inches) is identical with that ascribed to *P. versicolor;* the wings and tail are said to be shorter; the male is said to have the "red on occiput brighter, purple on throat less reddish (never decidedly red?), flanks brighter plum-purple, and rump more purplish-blue or lavender."

No. 296, p. 392. *Spermophila moreleti* becomes **Sporophila morelleti sharpei,** Lawrence, Auk, Jan. 1889, p. 53.

No. 277, p. 383. *Zonotrichia leucophrys intermedia.* The Committee now revert to this nomenclature, which the KEY has preserved in its 2d and 3d editions, 1884 and 1887, against the Union List of 1886.

No. 278, p. 383. *Zonotrichia gambeli.* The Committee now revert to *Z. leucophrys gambeli* of the orig. ed. of the KEY, 1872, p. 145.

No. 297 *bis*, p. 392. *Add:* **Euetheia canora.** MELODIOUS GRASSQUIT. A small West Indian Grassquit, originally named *Loxia canora* by Gmelin in the 13th edition of the Systema Naturæ, 1788, p. 858, and referred to its proper genus by Dr. John Gundlach in Cabanis' Journal für Ornithologie, 1874, p. 123, has been found on Sombrero Key in southern Florida. See Merriam, Auk, July, 1888, p. 322. So far as known it is only a straggler to our fauna.

No. 298 *a*, p. 393. *Pyrrhuloxia sinuata beckhami*, Ridgway, Auk, Oct. 1887, p. 347, is a new subspecies described from western Texas to southern Arizona and south into northwestern Mexico.

No. 298 *b*, p. 393. *Pyrrhuloxia sinuata peninsulæ*, Ridgway, Auk, Oct. 1887, p. 347, is a new subspecies described from Lower California.

No. 315, p. 403. *Molothrus æneus* becomes **Callothrus robustus**, Ridgway, Man. N. A. Birds, 1887, p. 589. (See Cabanis, Mus.

Hein., I., 1851, p. 193, note.) The genus *Catlothrus* of Cassin, Pr. Phila. Acad., 1866, p. 18, is adopted.

No. 316 *a*, p. 404. *Agelaius* [*lege Agelæus*] *phœniceus bryanti* is named by Ridgway, Man. N. A. Birds, 1887, p. 370, as a subspecies, the Bahaman Redwing, occurring also in southern Florida. It is said to be smaller than the common Marsh-blackbird, and the female to be lighter colored.

No. 316 *b*, p. 404. *Agelaius* [*lege Agelæus*] *phœniceus sonoriensis* is also named by the same author in the same place. It is said to differ from *A. phœniceus* in the same way that *A. p. bahamensis* does, but to be larger than the latter, with a smaller bill, and to have the upper parts lighter colored.

No. 338 *a*, p. 416. *Corvus corax principalis* is a large northern Raven named by Ridgway, Man. N. A. Birds, 1887, 361, but the assigned dimensions are well within the known range of individual variation of the common American bird. I am inclined to think that the latter is distinguishable from *C. corax* of Europe, and its tenable subspecific name is probably *sinuatus* of Wagler, failing which for any reason the next appears to be *carnivorus* of Baird, 1858.

No. 350, p. 421. The Committee decline to recognize *Cyanocitta stelleri litoralis* of Maynard, Ornith. and Oöl., April, 1889, p. 59.

No. 351, p. 422. *Cyanocitta stelleri annectens* of Baird (1874), which is in both the later editions of the KEY, but was rejected from the Union List of 1886, is now confirmed by the Committee.

No. 356 *a*, p. 424. *Aphelocoma californica hypoleuca* is described by Ridgway, Man. N. A. Birds, 1887, p. 356, from Lower California, in the vicinity of Cape St. Lucas; it is said to be smaller than *A. californica*, with larger bill and feet, paler blue back and whiter under parts.

No. 356 *b*, p. 424. *Aphelocoma floridana obscura* is described from the San Pedro Mountains of Lower California as *A. californica obscura* by Anthony, Proc. Cala. Acad. Sci., 2d ser., Oct. 1889, p. 75, and admitted by the Committee, under the latter name, in their Second Supplement, 1889.

No. 356 *bis*, p. 878. *Aphelocoma floridana insularis* is now recognized by the Committee as of specific validity.

No. 380, p. 438. A new subgenus **Nuttallornis**, Ridgway, Man. N. A. Birds, 1887, p. 337, is adopted for that section of the genus *Contopus* of which *C. borealis*, the Olive-sided Flycatcher, is the type.

No. 389 *bis*, p. 442. *Add:* **Empidonax cineritius.** ST. LUCAS FLYCATCHER. Most like *E. difficilis:* general coloration much duller; upper parts scarcely tinged with greenish; no decided yellow below, excepting on jugulum and abdomen; wing-bands brownish-white. Sexes similar. Wing 2.65; tail 2.40; tarsus 0.68. Lower California. Brewster, Auk, Jan. 1888, p. 90.

No. 391, p. 443. *Empidonax obscurus.* The alternative name **E. wrighti** (after Baird, B. N. A. 1858, p. 200) is now adopted by the Committee (see Brewster, Auk, April, 1889, p. 89). This is best, because Swainson's name *obscura* (Phil. Mag., 1827, p. 367) is not accompanied by a description which enables us to identify his bird.

No. 391 *bis*, p. 443. *Add:* **Empidonax griseus.** GRAY FLYCATCHER. Nearest *E. wrighti* (of Baird; *obscurus* of American ornithologists); larger and much grayer, the bill longer, the lower mandible flesh-colored on the basal half, in contrast with the blackish terminal portion. ♂, wing 2.68; tail 2.45; tarsus 0.72; bill 0.62; ♀ somewhat smaller. Lower California and probably Arizona. Brewster, Auk, April, 1889, p. 87.

20 A. Family COTINGIDÆ: Cotingas.

An extensive family of tropical and subtropical American Clamatorial Passerine Birds, to be now formally added to the North American Fauna, in which the *Clamatores* have long been held to be represented only by the *Tyrannidæ*. The *Cotingidæ*, though related to the *Tyrannidæ*, may be distinguished, so far as the two following genera

are concerned at least, by the extensive cohesion of the inner and middle toes, the reticulation of the posterior face of the tarsus, and especially by the shortness of the first primary in the male, together with the slight hooking of the bill.

126 *A*. **PLATYPSARIS.** (Gr. πλατύς, *platus*, broad; ψάρ, *psar*, a starling. Bonaparte, 1854; Sclater, P. Z. S., 1857, p. 72. Type *Pachyrhamphus latirostris*, Bonap.) BECARDS. Nostrils hidden by bristly feathers; hook of bill very slight, and bill not much flattened; rictal bristles long; head somewhat crested; 1st primary short; 2d emarginate in the male; tail rounded; tarsus with large scutella on the inner side. Sexes dissimilar. Two species occur on the Mexican border of the United States.

No. 394 *bis*, p. 444. *Add:* **Platypsaris aglaiæ.** ROSE-THROATED BECARD. ♂ adult: above, slate-gray, with the crown glossy black; below, ashy-gray, with a rosy patch on the throat. ♀ above dark rusty brown, becoming slaty on the crown. Length 6.60; wing 3.50; tail 2.75; bill 0.65. Eastern Mexico, north to the valley of the Rio Grande. (*Pachyrhynchus aglaiæ*, Lafresnaye, Rev. Zoöl., 1839, p. 98; *Pachyrhamphus aglaiæ*, Baird, Birds North America, 1858, p. 164, and Mex. Bound. Survey, 1859, II., pt. ii., pl. ix., fig. 1; *Platypsaris aglaiæ*, Sumichrast, Mem. Bost. Soc. Nat. Hist. I., 1869, p. 558.)

No. 394 *ter*, p. 444. *Add:* **Platypsaris albiventris.** WHITE-BELLIED BECARD. ♂ adult: resembling the preceding, but lighter and more ashy-gray above, the crown slaty, the under parts pale grayish, whitening on the belly. ♀ correspondingly paler than that of *P. aglaiæ*. Western Mexico, north into southern Arizona. (*Hadrostomus albiventris*, Lawrence, Ann. Lyc. Nat. Hist., VIII., 1867, p. 475; *Platypsaris albiventris*, Ridgway, Man. N. A. Birds, 1887, p. 325.)

126 *B*. **PACHYRHAMPHUS.** (Gr. παχύς, *pachus*, thick; ῥάμφος, *rhamphos*, beak. G. R. Gray, List Genera Birds, 1838, p. 41.) Resembling the preceding; bill more flattened, with shorter rictal bristles; tail graduated about ½ an inch; tarsus naked on inner side. Sexes very unlike. One species found on the Mexican border of the United States.

No. 394 *quater*, p. 444. *Add:* **Pachyrhampus major.** GREATER BECARD. ♂ adult: above, ashy-gray, becoming glossy black on the back and crown, and white on the scapulars; below, pale ash, whitening on throat, belly, and crissum; wings black, with white edging or tipping of the coverts and some inner secondaries; tail black, with white tips of the feathers. ♀ mostly chestnut brown, paler below, black on the crown and ends of the tail-feathers. Length 6.50; wing 3.25; tail 2.65; bill 0.60. Eastern Mexico, north to the valley of the lower Rio Grande; introduced to our fauna by Baird in 1858 under the name of *Bathmidurus major*, and figured in Report of the Mexican Boundary Survey, 1859, pl. ix, fig. 2, but like *Platypsaris aglaiæ* lost sight of for some years, and not yet recognized in the Committee's list. (See Sclater, P. Z. S., 1857, p. 78; Ridgway, Man. N. A. Birds, 1887, p. 326.)

No. 395, p. 450. *Nyctidromus albicollis* becomes *N. a.* **merrilli,** Sennett, Auk, Jan. 1888, p. 44. The Texan form is distinguished by its larger size (wing and tail each averaging 7.00 inches), prevailing gray coloration of the upper parts, and in the male the reduction or extinction of the white on the outer tail-feather.

No. 398 *bis*, p. 879. *Phalænoptilus nuttalli nitidus*, the Frosted Poor-will, is confirmed by the Committee.

No. 398 *bis*, *a*, p. 453. *Phalænoptilus nuttalli californicus* is proposed as a new subspecies from the coast of California by Ridgway, Man. N. A. Birds, 1887, p. 588, note, and confirmed by the Committee. Two skins are said to be "altogether darker than any from elsewhere."

No. 400 *bis*, p. 454. *Add: Chordediles popetue* **sennetti,** Coues, Auk, Jan. 1888, p. 37. This is that pale subspecies of the Nighthawk which is characteristic of the unwooded country from Texas to Dakota. It is recognized by the Committee under the name of *Chordeiles virginianus sennetti* afterward bestowed by Chamberlain, Syst. Tabl. Canadian Birds, 1888, App. A, p. 14.

No. 401, p. 454. *Chordediles popetue minor* becomes *Chordeiles virginianus* **chapmani,** (Sennett MSS.), Coues, Auk, Jan. 1888, p. 37.

No. 410 *bis*, p. 462. *Add:* **Trochilus violijugularis.** VIOLET-THROATED HUMMING-BIRD. ♂ adult: above, metallic golden green; sides dull green; flanks less green, the feathers tipped with brown; gorgelet violet glancing to steel-blue; wings dusky purplish with a buff line along the edge of the manus, the coverts dull green; primaries broad to the tip, that of the first recurved; tail slightly forked; its feathers broad except the last pair, which are narrowly linear; shafts of the outer pair abruptly angulated; middle feathers and base of second pair metallic green; rest dusky purplish; under tail-coverts white with green spots. Length 3.60; wing 1.80; tail 1.20; bill 0.75. Santa Barbara, coast of southern California. *Trochilus violajugulum* [sic] Jeffries, Auk, April, 1888, p. 168; A. O. U. Committee's Suppl. List, 1889, p. 10.

No. 413 *bis*, p. 464. *Add:* **Selasphorus floresii.** FLORESI'S HUMMING-BIRD. A Mexican species which has also been found in California near San Francisco. (Gould, Mon. Troch., III., Sept. 1861, pl. 139; *Trochilus floresii* (Loddiges), Gray, Handl., I., 1869, p. 144; A. O. U. Committee's Suppl. List, 1889, p. 10. See Bryant, Forest and Stream, June 24, 1886, p. 426.)

No. 429 *a*, p. 476. *Coccyzus* (or *Coccygus*) *americanus occidentalis* is described by Ridgway, Man. N. A. Birds, 1887, p. 273, as larger than *C. americanus*, with proportionally larger and stouter bill. Its habitat is given as the western United States, east to New Mexico and Colorado, north to Oregon, and south over the table-lands of Mexico.

No. 430 *a*, p. 476. *Coccygus seniculus maynardi* is a subspecies inhabiting the Bahamas and Florida Keys, possibly distinguishable from the ordinary Mangrove Cuckoo. It appears to be somewhat smaller, on an average, and paler buff on the under parts. It was named as a full species by Mr. Ridgway, Man. N. A. Birds, 1887, p. 274, and was reduced to a subspecies by Allen, with the approval of the Committee, under the name *Coccyzus minor maynardi*.

No. 434, p. 481. *Picus scalaris* is changed to *Dryobates scalaris* **bairdi** (after *Picus bairdi*, Sclater, in Malherbe's Mon. Pic., 1861, p. 118, pl. 27).

No. 437, p. 482. *Picus stricklandi* is changed to *Dryobates* **arizonæ,** Ridgway, Man. N. A. Birds, 1887, p. 286 (after *Picus arizonæ*, Hargitt, Ibis, April, 1886, p. 115).

No. 439 *bis*, p. 483. *Add: Picus villosus* **hyloscopus.** (*P. hyloscopus*, Cabanis and Heine, Mus. Hein., IV., pt. ii., 1863, p. 69; *Dryobates villosus hyloscopus*, Brewster, Auk, July, 1888, p. 252). This is the white-bellied race of Harris's Woodpecker which occurs in most parts of the western United States and southward into Mexico, as distinguished from the smoky-bellied form from the northwest coast. The distinction is noted in the KEY, p. 483, and I am inclined to think it worthy of recognition by name.

No. 441, p. 483. The Committee decline to recognize *Dryobates pubescens fumidus* of Maynard, Ornith. and Oöl., April, 1889, p. 58, which they regard as a synonym of *gairdneri*.

No. 441 *a*, p. 483. *Add: Picus pubescens* **oreœcus.** BATCHELDER'S WOODPECKER. Described by Mr. C. F. Batchelder in the Auk, July, 1889, p. 253, as *Dryobates pubescens oreœcus*, from the Rocky Mountain region of the United States. As compared with *pubescens* or *gairdneri*, it seems to offer a parallel case with that of *hyloscopus*, and the Committee have probably been right in recognizing it in the Second Supplement.

No. 458, p. 569. Under the name *Columbigallina passerina pallescens*, this pale form of the Ground Dove, which I have doubtfully kept in all the editions of the KEY, and which was rejected by the Committee in 1886, is restored in the Supplementary List of 1889, with the assigned habitat of Mexico and adjacent border of the United States from Texas to Arizona. It was originally described by Baird in 1859 as *Chamæpelia passerina?* var. *pallescens*, from Cape St. Lucas, according to my recollection of the original Xantus specimens which I examined in that year.

No. 474, p. 509. *Strix cinerea* becomes **Scotiaptex** *cinerea*, Swainson, Class. B. 1837, p. 217.

No. 475, p. 509. *Strix cinerea lapponica* becomes **Scotiaptex** *cinerea lapponica*, Ridgway, Man. N. A. Birds, 1887, p. 260 (after *Strix lapponica*, Retzius, Fn. Suec., 1800, p. 79).

No. 484 *a*, p. 514. *Glaucidium gnoma californicum* (*G. californicum* Sclater, P. Z. S., 1857, p. 4) is recognized as the Pacific Coast form of *G. gnoma*, from California to British America.

No. 485 *bis*, p. 515. *Add:* **Glaucidium hoskinsi.** HOSKINS'S PYGMY OWL. Similar to the preceding, but smaller and grayer; upper parts less distinctly spotted; forehead and facial disk with more white. Wing 3.30; tail 2.50; tarsus 0.75; chord of culmen 0.50. An interesting addition to our fauna lately discovered in Lower California. *G. gnoma hoskinsii*, Brewster, Auk, April, 1888, p. 136, but later accorded full specific rank by its describer with the approval of the Committee.

No. 486, p. 516. *Micrathene whitneyi* becomes **Micropallas** *whitneyi*, Coues, Auk, Jan. 1889, p. 71, the generic name originally bestowed being antedated by *Micrathena* of Sundevall, a genus of arachnidans.

No. 507 *bis*, p. 537. *Add:* **Falco regulus.** EUROPEAN MERLIN. (*F. regulus*, Pallas, Reise Russich. Reichs., II., 1773, p. 707; *F. æsalon* of most authors.) This well-known European and Asiatic Falcon, belonging to the subgenus *Æsalon*, is recorded as accidental at sea off Greenland. See Kumlein, Auk, Oct. 1887, p. 345.

No. 510 *bis*, p. 538. *Add:* **Falco tinnunculus.** EUROPEAN KESTREL. This well-known bird of Europe and Asia has been detected as a straggler in Massachusetts. See Cory, Auk, Jan. 1888, p. 110, and April, 1888, p. 205.

No. 513, p. 542. The subgenus **Tachytriorchis** of Kaup, Class. Säug. und Vög., 1844, recognized by Cassin in Birds N. A., 1858, p. 31, is now applied to that subgenus of *Buteo* of which *B. albocaudatus* of Vieillot (*Falco pterocles* of Temminck) is the type species.

Nos. 882, 883, p. 549. *Buteo "fuliginosus,"* as here intimated, is the same as *B. brachyurus*, and it has been eliminated from the Union List. See Scott, Auk, July, 1889, p. 243; Ridgway, Auk, Jan. 1890, p. 90.

No. 539 *bis*, p. 565. *Add: Columba fasciata* **vioscæ.** VIOSCA'S PIGEON. Similar to *C. fasciata*, but with the tail-band wanting or only faintly indicated, the general coloration lighter and more uniform, the vinaceous tints, especially, being more or less replaced by bluish-ash. Lower California. Brewster, Auk, Jan. 1888, p. 86.

No. 550 *bis*, p. 571. *Add:* **Geotrygon montana.** RUDDY QUAIL-DOVE. (*Columba montana*, Linn., 1758; *Geotrygon montana*, Bonap., Consp. Av., I., 1850, p. 72.) A long and well known inhabitant of tropical and subtropical America, including the West Indies and Mexico, lately found at Key West, Florida. See Scott, Auk, April, 1889, 160; July, 1889, p. 246.

No. 572 *bis*, p. 591. *Add: Ortyx virginiana* **cubanensis.** CUBAN BOBWHITE. Under the name *Colinus virginianus cubanensis* the Committee recognize a second variety in Florida and identify it with the Cuban form. In this the black marking of the under parts is in great excess, the male having the breast chiefly if not entirely black.

No. 574 *a*, p. 591. *Oreortyx picta confinis* is described by Anthony, Proc. Cala. Acad. Sci., 2d ser., II., Oct. 1889, p. 74, from the San Pedro Mountains of Lower California, and accredited by the Union's Committee as a recognizable subspecies in the Second Suppl. 1890. I have seen no specimens; but geographical considerations favor the view that this subspecies may be tenable.

No. 596 *bis*, p. 606. *Add:* **Hæmatopus frazari.** FRAZAR'S OYSTER-CATCHER. Resembling *H. palliatus* and *H. galapagensis;* differs from both in the broad zone of mottled black and white feathers across the breast; differs from *H. palliatus* in the stouter and more depressed bill, little or no white on the eyelids, darker back and wings, less varied upper tail-coverts, and some other respects; from *H. galapagensis* in the rather shorter bill, brown instead of black mantle, dark markings on the under tail-coverts, and

greater amount of white on the under primary coverts. Both coasts of Lower California. Brewster, Auk, Jan. 1888, p. 84.

No. 614 *bis*, p. 886. *Tringa damascensis*, the Long-toed Stint, which I admitted to the 3d edition of the KEY, 1887, though the Union List of 1886 declined it, has been reaffirmed by the Committee. See Ridgway, Auk, April, 1886, p. 275, and Man. N. A. Birds, 1887, p. 158.

No. 632 *bis*, p. 887. *Symphemia semipalmata inornata*, admitted in the third edition of the KEY, is confirmed by the Committee.

Nos. 636, 637, p. 639. The name of the genus *Rhyacophilus* is changed to **Helodromas**, Kaup, Naturl. Syst., 1829, p. 144.

No. 663 *a*, p. 662. *Add: Butorides virescens* **frazari.** FRAZAR'S GREEN HERON. Larger than *B. virescens;* darker colored and more uniform in color; neck more purplish, its sides as well as the forehead strongly glaucous; the light throat line more restricted. Wing 7.00; tarsus 2.25; culmen 2.50. From Lower California, in the vicinity of La Paz. *Ardea virescens frazari*, Brewster, Auk, Jan. 1888, p. 83.

No. 665, p. 663. The name of the genus *Nycterodius* (or *Nyctherodius*) is changed to **Nyctinassa**, Stejneger, Pr. U. S. Nat. Mus., 1887, p. 295.

No. 667 *bis*, p. 888. *Ardetta neoxena* is confirmed by the Committee as a valid species, and as a North American bird, under the name *Botaurus neoxenus*. For later references to this interesting Rail-bittern, see Cory, Auk, July, 1886, p. 408; Ridgway, Man. N. A. Birds, 1887, p. 127.

No. 672, p. 669. *Parra gymnostoma* becomes **Jacana spinosa,** Elliot, Auk, July, 1888, p. 297. (After *Fulica spinosa*, Linnæus, Syst. Nat., 10th ed., 1758, p. 152.)

No. 673, p. 672. *Rallus longirostris crepitans* is changed to *R. crepitans;* similarly, —

No. 675, p. 672. *Rallus longirostris saturatus* is changed to *Rallus crepitans saturatus;* also, *Rallus longirostris scottii* is changed to *Rallus scottii*. See Sennett, Auk, April, 1889, p. 165.

No. 675 *a*, p. 672. *Add: Rallus longirostris* **scotti.** SCOTT'S RAIL. Described by Sennett from western Florida in the Auk, July, 1888, p. 305, and approved by the Committee as a good species. It is later described in the following terms: "Bill slender, decurved, and compressed; upper parts sooty brown or black edged slightly with olive-gray; under parts dark ashy-gray mixed more or less with cinnamon; axillary and flanks slate-color, barred distinctly with white." For a synopsis of the several related species, see Sennett, Auk, April, 1889, p. 165.

No. 675 *b*, p. 672. *Rallus longirostris caribæus* [*lege caribbæus*], described in 1880 by Mr. Ridgway, Bull. Nutt. Orn. Club, July, 1880, p. 140, is now recognized by the Committee as North American, and its habitat assigned as West Indies and the Gulf of Mexico, north to Texas.

No. 694, p. 685. *Chen cærulescens*, which I have retained throughout my editions, is now removed from the hypothetical list and restored to full standing.

No. 709 *a*, p. 692. *Add: Anas obscura* **maculosa.** MOTTLED DUCK. ♂ top of head blackish-brown, the feathers edged with pale buff; chin and throat isabella color; cheeks buffy-white with narrow dark-brown streaks; breast, wings, upper parts, and flanks blackish-brown, the feathers margined with pale buff; under parts buffy-white, each feather with a broad blackish-brown spot near the tip; under tail-coverts blackish varied with whitish and reddish buff; four middle tail feathers blackish-brown, others fuscous edged with pale buff, having a V-shaped mark as in *A. fulvigula;* lining of wing white; speculum purple tipped with white; feet reddish-orange; bill with a small black spot on base of lower edge of upper mandible, lacking in the female. Sexes otherwise alike. A subspecies of the Dusky Duck which seems entitled to recognition. It occurs from eastern Texas to Kansas. It was originally described by Sennett as *Anas maculosa*, Auk, July, 1889, p. 263; and in the Second Supplement of the Union List, 1890, it is called *A. fulvigula obscura*.

No. 734, p. 712. *Somateria mollissima dresseri* becomes *S. m.* **borealis,** A. E. Brehm,

Verz. Samml. Europ. Vögel, 1866, p. 14. (See Ridgway, Man. N. A. Birds, 1887, p. 109.)

No. 747 *quater*, p. 890. *Add:* **Sula gossi.** BLUE-FOOTED BOOBY. Head, neck, and lower parts white, the head and neck streaked with dark gray; back and scapulars dusky brown, the feathers tipped with whitish; feet bright blue; bill and bare parts about it dull bluish; iris yellow. Sexes similar. Length 32.00–34.50; extent 62.00–66.00; wing 15.50–16.75; tail 8.75–9.75; bill 4.20–4.70. Gulf of California and south to the Galapagos (Ridgway MSS.), Goss, Auk, July, 1888, p. 241.

No. 747 *quinquies*, p. 890. *Add:* **Sula brewsteri.** BREWSTER'S BOOBY. Similar to *S. sula:* mantle ending uniform in color with the head and neck, the last two paler, especially in the male; iris dark brown with a narrow ring of grayish-white; claws glaucous-blue. ♀ adult: bill bluish-horn fading to dirty buff after death; lores slate-blue; space around eye, and gular sac, pale yellowish-green; legs and feet more yellowish; head, neck, breast, and upper parts sepia-brown, deepening on quills and tail-feathers; under parts from the breast pure white. ♂ adult: bill olive-blue; lores and circumocular space indigo-blue; gular sac bluish; legs, feet, and webs pea-green. Plumage as in the female. Length 29.50–31.50; extent 55.50–59.50; wing 14.50–15.50; tail 8.00; tarsus 2.00; bill 4.00. Southern Pacific Islands, north to lower California. Goss, Auk, July, 1888, p. 242.

No. 768 *a*, p. 741. *Larus barrovianus* is a Glaucous Gull described from Behring's Sea and adjacent waters from Point Barrow to Japan, by Mr. Ridgway, Auk, July, 1886, p. 330. It was admitted neither to the Union List of 1886, nor to the KEY of 1887; and I am at a loss to see upon what grounds it is rated as a good species in the Supplementary List of 1889, as *L. glaucus* is well known to vary beyond the limits of size said to be distinctive of *L. barrovianus*.

No. 775, p. 744. *Larus cachinnans* becomes *L.* **vegæ,** Stejneger, Auk, July, 1888, p. 310, after *L. argentatus* var. *vegæ* of Palmén, Bidr. Sibirisk. Vega Exp., 1887, p. 370, one of several conspecies of the Herring Gull.

No. 788 *bis*, p. 751. *Add:* **Chroïcocephalus minutus.** LEAST GULL. This almost cosmopolitan Gull and the smallest of its tribe, originally described as Asiatic in 1771 by Peter S. Pallas, and well known to be also European and African, was ascribed to North America in 1831 by Swainson and Richardson (F. B.-A., II., p. 426), on the strength of a specimen said to have been procured on Sir John Franklin's first expedition and identified by Sabine. In 1862, I included it in my monograph of the *Larinæ* (Proc. Phila. Acad., p. 311), but with doubt, and its alleged occurrence has never been accredited. It has therefore been omitted from all our late works. But quite recently it has been found on Long Island: see Dutcher, Auk, April, 1888, p. 171. The size is very small; length about 11 inches; wing 9 or less; bill 0.90, very slender; tarsus 1.00, and rather shorter than the middle toe and claw. The mantle is pale pearly-blue; the primaries are similar, white-tipped, and not crossed with black; and the adult in summer has a black hood.

No. 809 *bis*, p. 892. *Diomedea exulans.* This species, which I took in the KEY, orig. ed. 1872, removed from the KEY in 2d ed. 1884, and replaced on new evidence in the 3d ed. 1887, is placed by the Committee in the hypothetical List. See Coues, Auk, Oct. 1885, p. 387; Ridgway, Man. N. A. Birds, 1887, p. 51.

No. 823 *bis*, p. 781. *Add:* **Cymochorea macrodactyla.** GUADALUPE PETREL. An interesting petrel, apparently new and a valid species, described as *Oceanodroma leucorrhoa macrodactyla* by Bryant, Bull. Cala. Acad. Sci., II., No. 8, 1887. It appears to belong to our genus, as above, but we have not seen any specimens. The locality is Guadalupe Island, Lower California.

No. 887, p. 780. *Œstrelata gularis* becomes *Œ.* **scalaris,** Brewster, Auk, July, 1886, p. 300. (I cannot bring myself to misspell this

word "*Æstrelata*," as a majority of my respected colleagues on the Committee insist upon doing, for no better reason than that Prince Charles Lucien Bonaparte did not know how *Œstrelata* ought to be spelled. Such deference to authority as this is in my judgment a blot on our "Canons of Nomenclature," which justly exposes us to rebuke from "mouths of wisest censure." Many persons who do not know how to spell very well become successful authors through the friendly attentions of their compositors and proof-readers; and why should our Committee not be grateful for such assistance in the pangs and throes of orthographic delivery?

No. 865, p. 812. *Synthliborhamphus wumizusume* is considered by the Committee not North American, and consequently eliminated. (On this question, still open, see Stejneger, Pr. U. S. Nat. Mus., 1886, p. 524.)

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